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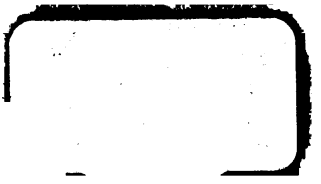
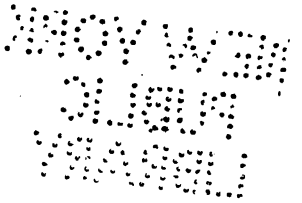


NOTE.—The principal papers preceding those here printed, containing the plans of operation for the work, and its putting into activity, are related in the "Philosophical Transactions of Philadelphia." Vol. II., new series. For those here printed, an attentive reader will need neither introduction nor notes.

F. R. HASSLER.



DOCUMENTS

RELATING TO

THE SURVEY OF THE COAST.

Philadelphia, June 11th, 1816.

MOST HONORED SIR:—The duty of every man is to be honest and to do good. Circumstances out of his control determine his sphere of activity. The independence of character of man is the greatest means to exercise his activity, according to these principles, and forms the chief part of his moral existence.

Circumstances have narrowed my sphere of activity. With a natural propensity, and the innate republican habit of devoting my life to general activity, I am obliged to confine myself within much narrower limits—I must find in the result of my actions a benefit for my family; the care of which is the natural duty of every man.

Your letter of the 5th instant brings me, after mature reflections, as well as by its first impressions, to this application of the first principles of all my actions. It obliges me to enter upon the question of the determination of my compensation in the work of the Survey of the Coast into more length, than I thought I should have to do, or like to do, because its result must determine completely the direction of my future life.

The proposed salary, of $2500 yearly, would not allow me more than the mere decent existence of my family, to the exclusion even of a proper education of my children; to which, by my constant employment in other concerns, I would be unable to bestow my personal care, and it would not procure to my family any lasting benefit from my work.

The subjection of my expenditures to the control of a final account, would subject my whole existence, in some measure, to the control of the accounting officers of the Treasury Department; who, by their absence from the work itself, cannot possibly have any idea of its incidences, and of whose principles of determination, and rules of office, I have not yet had an opportunity to form an opinion. It would take away from me that independence, and regard of the persons whom

it would become my duty to direct, which I think it is indispensable that a chief of such a work ought to have.

I have no ambition, and the life of a farmer has more charms for me than any other—it was my original view in coming to this country, and I abandoned it only by the compulsion of circumstances, against which honest exertions proved unavailing.

Though I feel as much as any man, the duty of establishing my family in as high a rank of society as may come within my reach, by honest means, yet, not only it must, but it is always very willing, to follow my fate, whatever it may be.

If the benefit from my work, is not likely to enable me to place my family in a decent standing in the rank of society, which I should occupy by it, I should do them great injury, was I to accustom them to the appearance of a station, in which I may leave them destitute, after my possible early demise in a work, which is for me not without dangers in point of health, and it would become my duty to apply the small remnant of its property to a farming establishment, apportioned to the means which may be at their disposition in future.

Before my departure for my mission to London, I mentioned to Mr. Gallatin my doubts, or even expectations, that it would not be advantageous to my economical circumstances. My prediction has been now verified by the following results:

On leaving Schenectady I sold all my moveables, some books, &c., though at low prices, to the amount of about one thousand dollars.

The death of my father in Switzerland, of which I got the intelligence on my arrival in London, gave me the means to assist my expenditures by realizing something of my inheritance, which I did to the amount of about one thousand and one hundred pounds sterling.

While in Paris the winter before last, under the impossibility of drawing upon my compensation, because of the protest of my former drafts upon the Treasury Department, the death of my mother-in-law in Switzerland, enabled me again to draw upon the produce of her moveables, &c., which I did to the amount of six thousand French francs.

To be able to pay my passage back from London to this country, and close my accounts there, you know that I have contracted a debt of four hundred pounds sterling, which I have yet to pay, under the great disadvantage of the present exchange of twenty per cent. premium.

So only accidental circumstances and good friends supported me, for upwards of two years, while the non-payment of my salary kept me in distress, and obliged me to great losses, and accessories which cannot be mentioned, but are easily inferred from the result of such a situation.

My account is in your hands, and you are, therefore, the better able to judge what it will produce to me, on account of the reimbursement of all this.

I thought I would avoid mentioning all this, and wished to consider my losses as a kind of outfit on my side, for a future advantageous establishment in the work, of which my mission was the beginning.

The reduction of my means forbid me imperiously to enter in future into any engagements admitting the chance of future losses, I should, though with regret, yet without any improper feelings, or expressions, abandon the future pursuits of work, in which I engaged with agreeable expectations; which I have attempted to bring to the point of an honorable execution, and to which I have devoted my time since my return from my mission, though uncertain in which light I should consider myself to stand in it.

The total sum of five thousand dollars yearly, mentioned in my letter of the 24th, will, as near as can be calculated, under any superintendent whatever, and at all events, be the expenditures of the Government for the part I comprehended under it. Defect in management will bring it higher—much more, particularly if the public should be chargeable with the expenditures in detail. In bringing these under the head of my own compensation, I consider it possible to subject them to a proper economy, while, if it was an object of account with the public, economy would be considered a reproach to me, by every one employed under me; and I should, on the other hand, have to bear the blame of any want of economy from those receiving my accounts.

My idea was, that I, for my part, and every one of the assistants or detail surveyors, for his part, should use his own stationary, drawing implements, and all similar, except what is provided by the collection of instruments, and calculated for such an arrangement.

The officers of the Corps of Engineers, standing in this respect all ready, under proper regulations, I thought these should extend to their assistance in this work.

If I should want any of them, at any period of the work, to calculate, plot, draw, &c., under my direction, in my own house, I wish it to be considered as an object of my private arrangement, and neither room-hire, nor fire-wood, &c., to be paid by government; because it is necessary that I shall be the full master of the arrangements.

My own living, in my absence from home, I wish not to be the subject of the observations of any body about me, or subjects to passing of accounts.

What relates to the military assistance, is fully explained in the plans of operation of 5th January and 15th May.

The expenditures to be put on the account to the Treasury Department, should, in my opinion, be no other than those relating to the preserving and keeping in order the instruments, and erecting of the signals.

Those two latter to be under the care of the officer first in rank accompanying me, without my interference or responsibility, otherwise than to order the work which may occasion them, and in case of necessity, verifying and acknowledging them. I have distinctly stated in my plan of operation, of the 5th January, as a matter of general arrangement of the work, that I think it proper, and even necessary, that I should be relieved from all accounting concerns, and that these should be referred as stated.

My task would be fully large enough, to make all the combinations, operations, and principal observations; to bring up the young officers given to me to the capability required for their employment, (as it will in fact be a practical school that I shall have to keep, besides the work,) and to direct, inspect, and verify, the detail surveys, and their uniting in proper charts, &c. To load me with any of the mechanical, or economical parts, would be impeding the work, to the great detriment of it, and place me in a situation not to be supported.

The following is therefore my proposition, as resulting from all the above observations.*

F. R. HASSLER.

The Hon. A. J. DALLAS,
Secretary of the Treasury, Washington.

TREASURY DEPARTMENT,
June 18th, 1816.

SIR:—Without making any comment upon the general topics of your letter of the 11th instant, I content myself with stating, that the President assents to allow you a salary of 3,000 dollars for your entire services, as Superintendent of the Survey of the Coast, to be made in pursuance of the Act of the 10th of February, 1807; and the additional annual allowance of 2,000 dollars, in full of all your expenses, upon the principles and propositions contained in your communications of the 5th of January, the 15th of May, and the 11th of June, 1816.

The details of the engagement will be reduced to form after your arrival at Washington, which you will expedite as much as you conveniently can. The accounts of your mission to Europe, have been submitted to the proper officers for settlement. The expense for preparing the instruments for use, with a just compensation for your agency, will be allowed. And the business of your superintendence may commence whenever you are prepared for it.

I am, very respectfully,
Sir, your most ob't serv't,
A. J. DALLAS.

Mr. F. R. HASSLER, Philadelphia.

Philadelphia, June 21st, 1816.

MOST HONORED SIR:—This morning I received your favor of the 18th instant, informing me of the President's assent to allow me a salary of 3,000 dollars a year for my entire services, as Superintendent

* These details appear hereafter, properly embodied and made authentic.

of the Survey of the Coast, to be made in pursuance of the Act of Congress of 10th of February, 1807, and the additional allowance of 2,000 dollars in full of all my expenses, according to the principles and propositions contained in my communications of 5th January, 15th May, and 11th instant.

I shall make every possible haste to come to Washington, leaving the preparatory part, in which I was engaged now, to apply to those which the season favors, particularly, according to what I had the honor to mention in my former letters.

I hope to arrive in Washington about the middle of next week.

F. R. HASSLER.

The Hon. A. J. DALLAS,
Secretary of the Treasury, Washington.

Washington, July 12th, 1816.

SIR:—Herewith I have the honor to deliver the more detailed articles of the agreement between the Treasury Department and myself, relative to the Survey of the Coast, as desired by the letter of the Secretary of the Treasury, under the 5th instant.

You will judge if I have expressed myself clearly, upon the subjects under consideration, or not; and dispose in consequence as you find most proper.

I have the honor to be,
With respect and esteem,
Sir, your most ob't, humble serv't,
F. R. HASSLER.

——— JONES, Esquire,
Treasury Department, Washington City.

Articles of Engagement between the Treasury Department of the United States and F. R. Hassler; relative to the Survey of the Coast of the United States.

A.—Mr. Hassler engages to bestow all his time, labor, and attention, to the work of the survey; as well to make, himself, the principal part of the general large triangulation, and the consequent calculations, as to superintend, and direct, the establishment of the observatories, and the officers of engineers, or naval officers, who will be engaged under his orders, in the detail parts of the work, and give them proper instructions to that effect; according to the plan proposed by him, under the 15th May, 1816.

B.—He will to that purpose, have the use of such instruments and books, of the collection he has procured, or which are yet to be procured, for the use in this work, as he may find necessary for his objects;

and give directions relative to those which are to be used by the officers under his direction.

C.—He will be provided from the Corps of Engineers, on his application to the General of said corps, with the following assistance to his own works, or such part of the same as he may deem necessary, according to circumstances, viz:

1. Two officers of engineers, topographical or others.
2. Some cadets of said corps, in number according to the circumstances.
3. Twelve men of said corps, for the most part artificers, with a corporal or sergeant.
4. One large baggage wagon with four horses, or two smaller ones, as he may require, with the necessary drivers to them.
5. Two saddle horses.
6. Tents for the accommodation of himself, the above mentioned officers, cadets, and men, and the shelter of the instruments.
7. The necessary field utensils, as well for the personal accommodation of the company, as for the works occurring; not comprehending Mr. Hassler's private equipment.

D.—Under Mr. Hassler's orders, the officer first in rank accompanying him, will have the chief command of the above military assistance, and act as treasurer upon the funds which will be given to said officer, to defray all the expenses of a public nature occurring, or ordered by Mr. Hassler; and said officer will render account upon these funds, to the Treasury Department.

E.—The following are to be considered expenses of a public nature, viz:

1. The keeping in order, and securing from injury, of the instruments, belonging to the Government, their stands and boxes, and the fitting them up for use.
2. Such additions to the collection of instruments and books, as may be found necessary by Mr. Hassler in the progress of the work; as well to complete the collection from time to time, as to furnish a sufficient number of them for the use of the detail surveyors.
3. The construction of the signals, and signal lamps, and their attendance and protection.
4. The preparations of the stations for the convenience of observation, and the securing of them for future utility.
5. The transport of the instruments, and the baggage of the company.
6. All expenses consequent or relating to the keeping in order, and maintenance, of the military assistance, stated in article *C*.
7. All expenses for the establishment of the permanent, or temporary observatories, to be erected according to Mr. Hassler's plans.
8. The printing of blank formulas of journals and calculations, for the detail surveyors, if such are found advantageous, as it is probable.

F.—Mr. Hassler will receive, as compensation for his personal work in the survey, his superintendence and direction of the whole, and all his personal expenses consequent thereof, the sum of five thousand

dollars annually, to be paid quarterly on his drafts upon the Treasury Department, or otherwise.

G.—It is understood that the work shall not be carried on in the form of a bureau, or office; but that Mr. Hassler himself, as well as the officers under his direction, shall execute such work as devolves upon them, or are ordered to them, in the field, by defraying their own personal expenses, and at home in their private quarters. Therefore, no accounts will be admitted upon room-hire, fire-wood, stationary, or smaller drawing implements, not provided by the collection of the Government. The above mentioned compensation is to be considered compensating all his personal expenses, in his absence from home, in the work of the survey, and the items here mentioned, required for his personal use in this work; exclusively only of the expenses stated as of a public nature in article *E*.

H.—The appointments to be made in future to officers, undertaking separate parts of the work, will be fixed so as to comprehend the same articles, and to follow the same principles.

I.—If, therefore, Mr. Hassler shall at any time require officers to work under his direction in his quarters, it will be at his option, and entirely a matter of his private arrangement. Otherwise, every officer is to be understood to execute his housework in his own quarters.

K.—From these regulations are excepted:

1. All expenditures relating to the use of vessels or shipping for soundings, and the nautical part of the survey, for which proper arrangements will be made in time by the Treasury Department, upon propositions to this effect.

2. The clear executed copies of the maps and charts, either general or special, which will be required by the proper authorities, or prepared for publishing; for which, proper draftsmen will be appointed, and paid according to separate arrangements, to be made with men who may have applied to such works with particular success.

3. All expenses and consequences of engraving, printing, publishing, or executing such number of copies of the maps or charts, as may be required for this purpose, or desired by the Government, or the officers to whom it may belong.

F. R. HASSLER.

Washington, July 12th, 1816.

TREASURY DEPARTMENT,
3d August, 1816.

SIR:—The correspondence and documents relative to your being employed as Superintendent of the Survey of the Coast, under the act of Congress respecting that object, have been submitted to the President, and your services are engaged on the following terms:

1st. The whole of your time, labor, talents, and attention, shall

be given to the work, as well in relation to the superintendence of the duties to be performed by military or naval officers and assistants, or by draftsmen and engineers, as in relation to the parts of the work which are to be executed by yourself.

2d. You will be provided with competent assistance of officers and men from the corps of engineers and from the navy, with tents and field equipage, with baggage wagons and horses; and you will have the free use of the public instruments and books for the purposes of the survey.

3d. The party of officers, men, and assistants, accompanying you, will be ordered to conform to your instructions; and all the incidental expenses of the survey which are of a public nature will be defrayed by the government; but your own personal expenses are to be defrayed by you, whether you are employed at home or abroad.

4th. Funds will be placed from time to time, upon your requisition, in the hands of the chief officer accompanying you, to be disbursed, upon your order, in the payment of the expenses of a public nature, and to be accounted for by him at the Treasury once, at least, in every three months.

5th. You will receive in full for all your services a compensation at the rate of 3,000 dollars per annum, and for your personal expenses an allowance at the rate of 2,000 dollars per annum; to commence on the 18th day of June, 1816, and to be paid quarterly at the Treasury upon your drafts.

6th. You will make frequent reports of your progress to this department, and deposit here all the surveys, drafts, notes, charts, maps, journals, and documents in any wise belonging to the survey of the coast; and you will return the public instruments and books to such place as shall be directed, when they are no longer required for the business of the survey.

7th. If at any time it should be necessary to explain the nature and extent of your employment and engagement, your communications to this department, and particularly the articles submitted by you on the 12th of July, 1816, will be resorted to.

It only remains to repeat the President's solicitude for a successful and speedy execution of the great national work which is thus confided to you, and to assure you of the esteem with which

I am, Sir, your most obedient servant,

A. J. DALLAS.

Mr. F. R. HASSLER.

To the care of ROBERT PATTERSON, Esq.
Director of the Mint, Philadelphia.

Copy certified conformable to the original,

F. R. HASSLER.

Philadelphia, 18th August, 1816.

On my return to New York, the 16th instant, from a reconnoissance on Long Island and Connecticut, I was honored by your favor of the 8th instant, announcing the President's approbation of the special terms of my appointment for the Survey of the Coast, being that

1st. The whole of my time, labor, &c. shall be given to this work, &c. (repeating here the terms of the said letter); to all of which I shall conform myself duly and to the best of my abilities.

Major Abert having not yet been provided with means to second me, when I passed at his abode, on setting out from here the 29th of last month; nor General Swift yet been able to procure the necessary men and other requisites to assist me, I proceeded with three cadets of the Military Academy, then just present at New York during their vacancies, who joined me, upon the invitation of General Swift, through Long Island and Connecticut.

The details and results of this reconnoissance I reserve for a report upon the whole when continued on the south of New-York Bay, along the Jersey shore to the mouth of the Delaware, till to which it became necessary to proceed, before I can fix upon the details of my plan of operation in this quarter. General Swift expecting in a few days to procure the means, and Major Abert to be possessed of the necessary funds to activate the proper required assistance, I chose this intermediate time to effect, without impeding the work of the survey, the removal of my family from this to Newark, where I intend to fix my future residence, and intend to set off from here to-morrow.

You would very much oblige me, Sir, if you would be so kind as to assist me in the establishing of my family in its new abode by the advance of the part of my compensation from the 18th June, date of my appointment, to the 1st October next, time which would bring the quarters of my compensation in a regular run with the year. I take the liberty to say, also, that this may be done by drawing on the State Bank of Newark, directed to me there, if a draft upon New York, in which state my expenditures for the survey will be made, cannot be obtained, which would avoid the partial loss yet incurred upon a draft in Newark, but more southern drafts or notes would occasion to me too considerable losses.

I am, &c.

F. R. HASSLER.

Honorable A. J. DALLAS,
Secretary of the Treasury, Washington City.

Brooklyn, 5th Nov. 1816.

DEAR SIR:—After having written to Washington, to know if I should supply you with articles of transport, &c., it occurred to me that my business at West Point would prevent my doing any service;

further, I think it will be found cheaper and more convenient to you for Major Abert to procure carriages as you require them, and to have your signals constructed as near the place where they are to be used as you may be able to find carpenters and lumber for tripods, &c.

The small quantum of gunpowder that you want had better be purchased by Major Abert. The tents Major Abert can procure from the Quarter-master General by an order from the Secretary of War.

So you see how I propose to have no trouble; but this is not my object. I believe the mode that I have mentioned will be found most convenient to all parties.

Yours, affectionately,

J. G. SWIFT.

Mr. HASSLER, New York.

Newark, New Jersey, 23d Nov. 1816.

MOST HONORED SIR:—Herewith I have the honor to forward to you my first report upon the work of the Survey of the Coast, containing the result of all that it was possible to do since the time of my appointment.

I postponed it until now, intending to present in it together all the operations made for the purpose of finding a proper locality for the base line and the system of the first triangle, which, as one of the fundamental works, it is proper to do with full knowledge of the locality and configuration of the country to be surveyed. You will see that circumstances, however, prevented me, to do this as fully as I would wish, though I made every possible exertion towards it. It would be very important for the advancement of the work that I should be enabled to make this fall yet the works necessary to arrest fully the plan of operation. I am very desirous to do it, though at this season works in open fields are not without disagreement.

On speaking lately with General Swift upon the manner of providing the necessary assistance for the work of the Survey, which, according to my plans, was intended to be provided by the War Department, the following ideas occurred, which I wish to present to your consideration:

1. For the transport of the instruments, next spring and in future, when the best instruments of the collection will be used, and particular care required for them, the conveying of them by hand of men, which is the best mode, would require such a number of them as could not be spared in the corps of engineers, and would be very expensive; that it would therefore be more advantageous, and even the only practicable way, to have a spring carriage constructed, of proper dimensions and proper arrangement for that purpose, and to furnish it with two horses and a driver, in like manner as it was done in the survey of England, though the operators in that work have recorded in their journal frequent complaints of their theodolite being injured by the

conveyance. But the two-feet theodolite of Mr. Troughton, in the Government's collection, is of far better and more secure construction; so that, with proper care, and the slow path naturally adopted in the conveyance, I should think as well this as the other necessary instruments could be well trusted to such a carriage.

2. For baggage and necessary tools, it seemed proper to make use of the wagon and horses which Major Abert has procured as long as they may serve, requesting only a driver to it.

3. For any conveyance of larger bulky things, stands, signals, &c., which will be required only when moving at some distance, or on certain occasions, it would be the cheaper plan to make use of hired assistance.

4. For the measurement of the base line, next spring, the number of men mentioned in my plan for putting the Survey of the Coast into operation is absolutely required. According to General Swift's account, they cannot be spared from the service of the corps of engineers. A certain number of them will also be required for all future times; it will therefore be necessary to provide them by some arrangement. Their numbers will however in part depend on the number of cadets from the Military Academy who will follow the work. When the time of work for next spring draws nearer, and I shall be informed of the means that may be furnished, I shall try to adapt to it as much as possible, and be able to be more precise in this respect.

5. As no carriage like that mentioned in the first article here, nor tents and the other articles, mentioned as requisites in my plan of operation, are present in the military stores, and no expenses authorized for it in the War Department, it might be most proper to furnish Major Abert with instructions and means to procure them.

I have just received a letter from Major Abert, stating that he had been refused funds which he had required for the public expenditure, to enable him to accompany me in the proposed works, and to defray certain expenditures which I had mentioned to him as to be encountered now, because, according to the arrangement of the Treasury Department with me, funds were to be given only upon a request from myself. We are, therefore, stopped in our further proceedings at present.

I take the liberty to state, upon this subject, that this request has been made by me, before I left Philadelphia for reconnoitering, and that I have mentioned the sum of at least 2,000 dollars as necessary to put to his disposition for the different expenses to be encountered before next spring. I have also at the time given in an estimate, naming the items of expenditure, among which I did not comprehend either the maintenance of the soldiers and the horses, or the purchase of horses and wagon, both of which I had considered as part of the requisites to be furnished by the War Department, free of expenditures from the funds of the Survey.

The sum mentioned has been only partially received by Major Abert, as I understand, for which part he will be able to give account; the disbursements hitherto occurred have all been in consequence of travelling for reconnoitering, and some temporary signals; therefore, the

items stated in my estimate, and now at hand to be disbursed, remain yet, as they were stated at the time; and if the proposal of article 1st, heretofore, meets your approbation, it will be proper to insert it at the rate of six or seven hundred dollars probably.

I must however observe, that all the estimates in detail which I am obliged to attempt can yet be but extremely vague and uncertain, and that it is impossible to make an accurate estimate before some progress in the work will have furnished me with experience to ground a judgment upon; and as it seems that nothing will be furnished from the military stores, the articles for which I relied upon them must necessarily be added, and augment the disbursement.

Not to be uselessly prolix here, I take the liberty to refer, for all these particulars, to my former plans, letters, and other communications, made at different times, and a letter which General Swift has written to the War Department in consequence of our conversation.

F. R. HASSLER.

The Hon. W. H. CRAWFORD,
Sec. of the Treasury, Washington.

TREASURY DEPARTMENT,
November 30th, 1816.

SIR:—I have to acknowledge the receipt of your letter of the 23d instant, accompanied by a report of the progress made by you in the Survey of the Coast.

Considering that the season for active operations is drawing to a close, and consequently, that answers on all the points alluded to in your communication, are not immediately required, I will confine myself at present to remarking, that as you must necessarily be most competent to decide on the means best calculated for the transportation of the instruments, baggage, tools, &c., I have no hesitation in confiding the management of the business to yourself, under a firm persuasion, that in the measures you may adopt, all possible attention will be paid to economy.

Whatever may have been the understanding on the subject of advances of money, it is proper to observe, that, not only the uniform usage of this Department, but the agreement also requires, that every advance so made, shall be preceded by a requisition from you. Whilst this arrangement, therefore, can be productive of no inconvenience to you, it will obviously supercede the necessity of my maintaining a double correspondence with Major Abert and yourself.

I am, very respectfully,
Sir, your ob't serv't,
WM. H. CRAWFORD.

F. R. HASSLER, Esquire,
Newark, New Jersey.

Newark, N. J., December 18th, 1817.

MOST HONORED SIR:—Unforeseen expenses occasion me to take the liberty to request the favor, to forward me the amount of my compensation for the quarter, which will expire the first of next month, by a draft of 1250 dollars, upon any of the banks of this neighborhood. You will oblige me very much by it.

I have just returned from Rockaway, where the bad weather has frustrated me of the hope to make that station yet this year, which, therefore, remains postponed to next spring, with some more in that neighborhood.

I intend to take some of the first fair days, to make the station at the north end of the base, and shall later make the observations on the station here, in the high part of this town. I shall also, in the course of this winter, make a series of latitude observations here; and, for that purpose, fix a proper sheltered place for observing.

The verification base having agreed in its measurement so exactly, with the results of the calculations, the execution of the two stations above mentioned, during this winter, will enable me to propose the beginning of detail surveys next spring, though the base in English Neighborhood is not yet measured with the means of accuracy, which it is intended to employ, by the apparatus intended for it. The possible difference, affecting only very large distances, I dare safely postpone this, so very important part of the work, until next summer. It becomes, therefore, interesting to know the intentions of the Legislature of this State, in respect to the plan I proposed; for which purpose, I shall in a few days speak with the Governor, who has, in answer to my letter, said he would propose it, and expected an early decision, in what is called the long session in January.

I have the honor to join here, on a small scale, a sketch of the triangles executed this year, within which the detail survey can be begun. In the course of this winter, I shall have the honor to present to you the results of the calculations, and the projection of the triangles, on the papers to be used for the detail surveys, which I shall now work upon.

I have the honor to be, &c.

F. R. HASSLER.

The Hon. W. H. CRAWFORD,
Secretary of the Treasury, Washington.

Newark, N. J., April 3d, 1818.

MOST HONORED SIR:—I take the liberty to request, that you will be so good to forward to me a draft upon some bank of this neighborhood for 1250 dollars, as amount of my quarterly compensation, which becomes due the 1st instant.

The calculations upon the works in the survey of last summer, have advanced so far, that all triangles are calculated. I am now engaged in the calculations of the differences of latitudes and longitudes from them, and the azimuth and latitudes observed, which latter are already calculated, and the reduction of them upon one point begun. I have also prepared the elements of the projection by which they are to be brought upon paper, to be used in the detail surveys.

To obtain all the results of the quantity of work at hand, after having protracted the summer campaign of field work until January, in order to have the honor to present it in full to you, together with the necessary propositions for beginning the detail survey, before the season would again open for field operations, has obliged me to so close confinement, that my health has been considerably affected by the great change between this and the active summer work in the open air. I hope, however, in a short time to have it completed, and to have the honor to present it to you.

I have the honor to be, &c. &c.

F. R. HASSLER.

The Hon. W. H. CRAWFORD,
Secretary of the Treasury, Washington.

TREASURY DEPARTMENT,
April 6th, 1818.

SIR:—In conformity with the request, contained in your letter of the 3d instant, measures have been taken for remitting to you the amount of your salary for the last quarter.

Permit me, sir, to avail myself of this occasion, to apprise you of the absolute necessity for forwarding to this office, without delay, the result of your past labors, accompanied with an estimate, as well of the time required to complete the Survey of the Coast, as of the probable expense attending the same; for it must not be dissembled, that the little progress hitherto made in the work, has caused general dissatisfaction in Congress, which, if not removed, may lead to a repeal of the law under which you are now acting.

I am, very respectfully, &c.

W. H. CRAWFORD.

F. R. HASSLER, Esquire,
Newark, N. J.

Newark, N. J., 9th April, 1818.

MOST HONORED SIR:—Your favor of the 6th instant, received this morning, obliges me to enter into a lengthy discussion upon the subject of the Survey, as well relative to my work in it hitherto, as the principles of it, according to the plans approved by the President, Mr. Jefferson, and Mr. Madison; it will also best answer the question of time and expenses, which it is impossible to answer in numbers nearer than what I have done in my letter of the 14th February, 1817.

The circular letter of the Treasury Department of the 25th March, 1807, requested me, like all other persons who received a like one, "to suggest the outlines of a plan as may, in my opinion, unite correctness and practicability."

By a number of other gentlemen, who had given in plans like me, (I believe ten—eleven), my plan, under date of 2d April, 1807, was approved of, joined, and recommended to government, in preference to theirs, without my knowledge, in a special conference, held at Robert Patterson's, Esq. in Philadelphia, upon directions to that effect from the President;—the report will be upon record in your office. Mr. P. communicated this to me the 21st July, 1807, mentioning, at the same time, that the execution was suspended on account of the political aspects, requesting me, however, to propose the necessary instruments, which having done under the 10th August, 1807, Mr. Patterson proposed to me if I would go to England to direct their construction, for which I declared myself willing when required.

There the whole rested until 16th April, 1811: it was again taken up by direction of the President, in consequence of which I set off for London the 30th August, 1811, and returned with the instruments the 28th October, 1815. I need not to enter here into detail upon this epoch, as it may be considered as settled, except the consequences of the unlucky circumstances in which I was left in London, which you know hang yet over me in a very disagreeable law-suit.

It was not until August, 1816, that I was actually appointed to work in the Survey; I must therefore request that all the time from the passing of the law, 10th February, 1807, to middle August, 1816, be left out of consideration, when the question is asked, what work has been done in proportion to time?

I went immediately into activity for reconnoitering, a preliminary as necessary as the viewing of the ground upon which a building is to be erected. No funds had yet been given for the public expenditures, which I defrayed myself. In the fall of the same year, you will recollect, by my letter, and the report of the 23d October, that my nearer inquiry for a base line was again stopped for want of funds, as I had then gone to the end of my own disposable funds. Your letter of the 30th November, 1816, had postponed also the decision upon various subjects, on consideration of the season for active operations drawing to a close. It was due to these circumstances that the proper locality for a base, this first requisite in any survey whatever, was not found until April, 1817, and all the consequent plan-

ning of the work to be grounded upon could only be done afterwards.

I must also take the liberty to recall to memory my situation relative to assistance, which is in part contained in many of my letters, especially those of 2d April and 6th August last year, and 2d February of this year, and add to these informations the following:

The letter from the Treasury Department to me of the 3d August, 1816, under sanction of the President, says, art. 3d, "The parties of officers, men, and assistants, will be ordered to conform to your instructions;" a measure absolutely necessary for the chief of such a work.

Major Abert, who was before acquainted with my plan of operation, was ordered by you, when Secretary of War, to report himself to me, but had no instructions referring to me, and was not ordered to conform to my instructions; the consequence of which was, that he did not find himself obliged to more than what he found discretional, and, for instance, has the free disposition of his time without my control. I intended to request some regulations in this respect this spring.

As evident by my reports, I had no assistance at all during the winter before the last, which he passed at Mount Holly. I had hired a man, at my own expense, for the many works in which I needed assistance. He was not with me at the inquiries relative to the base of Long Branch, for want of funds, as by my report of 23d November, 1816. He was absent while I was on Weasel Mountain, a few days excepted. Last winter, he passed about three months in Washington, &c., and followed completely different orders from the War Department. (Upon this I must yet remark, that it rests with the Treasury Department, and not with me, whether his compensation for that time, which appears in his last quarterly account, is to be paid to him in consideration of his responsibility for the funds.)

I must state a consequence of the circumstances more important to me. His independent situation and absence have produced very disagreeable situations for him and for me, and reduced his services to the mere mechanical parts and the keeping of accounts, which alone he had in his orders; therefore, he has also not made the progresses in the scientific part which should now already make him my chief assistant in this respect.

Various other circumstances I omit, and take only the liberty to observe, that it was not until the beginning of last January that I had the number of assistants promised to me by art. 2d of the Treasury Department's letter, and that in the three lieutenants of artillery now present, lately come from the Military Academy, who had, notwithstanding their application to the studies there, not the practical knowledge which might have rendered them useful for more than mechanical calculations. No more could be expected from them with any right. They are now only beginning to gain insight into the nature of the work, by which, and future studies, they may become more useful in future. Before that, my son was often my only assistant, who has been with me all the time, at my own expense, and without any compensation.

My actual work on triangulation, except the preliminary base measurement, began only the 15th July of last year, and I protracted

the summer work till the end of December, when none about me thought it possible to stand it any longer for cold. This is only about five months, of which at least five weeks were rain, as my journals may prove.

No angle has been observed to use but by myself: that I have been up and at observations, with or before sun-rise, is proved by my journals; and the taking out of the results occupied me most commonly till about eleven o'clock at night. All this was witnessed enough by every person about me.

In less than four months, therefore, I formed about eighty triangles, by which the respective distances of about forty places or points are determined to a degree of accuracy which I think more than sufficient and satisfactory for the present purpose of my work. I have measured two bases, verifying them by a coincidence above expectation. I have determined a sufficient number of latitudes and azimuths to place the work in its proper place on the earth, and given to it its proper direction.

The detail of surveys which, according to correct principles in this kind of work, are to be grounded upon this, can be begun next summer, as well by land as by water, as stated already in my letter of December last, and extend over all that may be wished for the shipping to the harbor of New York, in its interior waters, and the defence of the same, as I think all this must naturally be the aim of the Survey to answer the ends of government. I have done more since August, 1816, than has been done in the beginning of the English survey, a work parallel to this, in double that time, with choice assistants, and at far more expense, as you will see by the description of it, of which I take the liberty to join here the copy procured for the use of the Survey of the Coast. I must only observe, that the naval part is not published, as a matter of political precaution. I pray you will return it after perusal.

The calculations to be grounded upon the observations of last summer, forming the elements for the future works, were to be made with great care and comparative weighing and combination of their results. They must be all united in one system, and all those of an equal nature be compared and reduced, one upon the other, before a final result is to be decided upon. They must, for all future parts of the work, determine the degree of reliance which is to be put upon each kind of observation, the degree of accuracy obtainable by a certain number of observations, or mode of observing, which, as I stated in my report of last August, is to be found out for every individual instrument used in accurate work. Without this the future work would continue to be trials after trials, which would greatly delay the work. I can have the pleasure to state, as a result of these inquiries, that when I shall have observed twice upon a signal, according to the method of observation I determined upon, I am sure within the size of my signal, that is fifteen inches, therefore sufficient for secondary points; and such two observations can be made, for about six or eight points, within two hours; but to find this, I had to repeat my observations frequently at first.

But I will not trouble you here with scientific discussions, which, though closely connected with the subject, appear not to be the object of the remarks in Congress which you communicated to me; and, in fact, could not be; as the subject has not been discussed there from the side: *How* the greatest accuracy, obtainable within certain limits of time, was to be obtained, in order to unite accuracy with economy and speed, this was my task.

As I have, of course, employed in the mechanical parts of the calculations the three lieutenants of artillery, who have passed this winter with me, it could not otherwise but that they had to be repeated several times, as they could not be expected to do them, at first sight, without errors, to which even able calculators are subject.

You see easily by all this how many circumstances united to delay the final conclusion of these works, more than would ever be the case in future, as it would soon be possible to make the calculations in the field even, in proportion as the data for the same are obtained.

I had the honor to state to you, in my letter of the 3d instant, how far these calculations are advanced; the work is, of course, continuing as fast as possible.

It would be improper to forward you the work in its present state, and so near being brought into the proper shape for its future usefulness. Much of my work would be lost by it; it would take a very long time to a new man in the business to make proper use of it without my directions; and if given out of my hands at present, it would be impossible for me and my assistants to go a step farther.

It was always my intention to have the pleasure to present you the work when in its proper state, as I said in my last letter; and I expected this to be the case in the course of next month. If, however, you should determine otherwise, I shall act exactly according to your orders.

I cannot help thinking that the execution which I have given to my plan hitherto, and which will become always easier in future, would, on proper inquiry, always be found reaching the aim proposed to me, "to unite correctness and practicability;" and I can add with confidence, celerity and economy above any other schemes. You would therefore oblige me exceedingly, if it is ever in your power, to communicate to Congress this letter, as well as my plans of operation of the 5th January and 15th May, 1816, and my special articles of agreement of the 18th July of the same year, with any such as you may find proper quoted in the present. I join, for the same purpose, several copies of the sketches of the main triangles executed last, which I communicated to you last December, and which give an idea of what has been done. I think these communications are necessary to Congress, to judge with justice, and comparatively, upon the manner in which I have acted upon the plans approved by the President, and how I have executed my engagements.

On your request, I could, in a few days, communicate to you also the numerical results of the triangle in a copy made for the purpose.

I must acknowledge I feel it hard, to be said to have given general dissatisfaction, when I am conscious of having done my duty, I might

say, to excess, as I did it till to the detriment of my health, under difficulties which did not depend on me, in order to administer practically the proof, that the advices and plans I had given in time upon the best mode of operating were proposed with the most honest intentions, and would as certainly reach the aim in all points required.

The communication I pray for would certainly vindicate my honor in this respect. This is my only reason for wishing this communication, as no personal consideration should lead Congress, instead of a due, unprejudiced consideration of the subject.

I must add one more observation relative to the acceleration of the work. My first plan of 1807 proposed to send two surveying parties at once out, one in the southern, the other in the northern part of the coast, intended to be divided about the state of Delaware. Upon Mr. Gallatin's orders, the instruments were mostly all procured double, for this express purpose. I referred to this arrangement yet in the plan for actuating the work, under the 5th January, 1816; but being then told there was no person at hand to take up the second part, I had to act according to these circumstances, and make my plan of 15th May, 1816.

(This circumstance has enabled me to furnish from the collection the necessary instruments for the boundary line with Canada, which, I was happy to hear, has procured to the commissioner of this country the credit of having brought better instruments than the English, who wrote back to get others.)

If there is any person now at hand to take up such a part, to go to work on the southern coast at the same time, this circumstance might tend to accelerate the final execution of the work. There are yet some instruments at hand that could be got for it, and some of those sent for the northern boundary could, I think, be spared from it, and employed to this use.

This measure would give me great satisfaction; it would also return nearer to my original plan, which was judged the most advantageous.

It remains to me now only to take the liberty to request the favor of an early answer for my direction.

I have the honor to be, &c. &c.

F. R. HASSLER.

WM. H. CRAWFORD,
Secretary of the Treasury of the U. S.
Washington City.

Washington City, April 14th, 1818.

MOST HONORED SIR:—After writing the enclosed letter, I found it would be more proper for me to come myself to Washington with the work, as I could also give with it every explanation which may be required.

I arrived last night; having run post haste, I am over-fatigued. Some of my papers have by the same circumstance been rubbed, so as to be unpresentable. I must copy them.

In the mean while, being at hand, I shall be ready whenever called upon for any explanation that may be wished.

Knowing the press of your business at this moment, I considered it best to communicate this to you in writing.

I am yet at the tavern of Davies, but engaged in finding a private lodging, that I may be more undisturbed at work.

I have the honor to be, &c. &c.

F. R. HASSLER.

WM. H. CRAWFORD,
Secretary of the Treasury of the U. S.

Washington City, April 22, 1818.

MOST HONORED SIR:—The act authorizing the Survey of the Coast, having been repealed by Congress, it is my duty to make you some propositions relative to the preservation of the work which has been done, arising out of the following considerations.

The stopping of this work, which has no protecting law for the preservation of the necessary signals and station points, discrediting it in the public opinion, it is not to be expected, that without precautionary measures the station points, which have been determined with so much care and accuracy, will remain preserved.

The work of the calculations being interrupted unexpectedly, it cannot be supposed to be in such a state as to speak every where by itself, without explanation.

Some of the accessary requisites of the survey, will have to be disposed of, to stop the expenses of their maintenance.

The instruments will require care for their preservation.

I take, therefore, the liberty to propose the following measures:

1. That Major Abert and Lieutenant Adams be recalled from the survey, to save the expense of their appointment, of $3.75 per diem.

2. That Lieutenant M'Neill and Lieutenant Vinton, be ordered to stay with me until the dispositions hereafter mentioned are executed; their assistance being sufficient, and preferable.

3. That Major Abert be ordered to pay into the hands of Lieutenant M'Neill, the balance of the public moneys he has yet in hand.

4. That in addition to this balance, five hundred dollars be sent to Lieutenant M'Neill, to Newark, N. J., to defray the public expenses necessary for the dispositions hereafter to be mentioned, and the allowance of $1.25 per diem, for himself and Lieutenant Vinton, as by disposition of the Treasury Department. Enjoining Lieutenant M'Neill to render account of said sums to the Treasury Department.

5. That I be ordered to go round to all my stations, to take away

the signals, and properly secure in the ground the earthen cones which I have placed on many of the stations; to put such cones in those stations which have not yet any; and, at those stations on the rocks, make proper permanent marks in those rocks.

I shall, in this turn, need the assistance of the two officers named, the soldier, and the two drivers, together with the two carriages and the horses, all now at hand for the use of the Survey of the Coast. As the persons, signals, and cones, are to be brought to places in a circuit of more than fifty miles, and manual labor is to be performed there.

These works will occupy me, with my assistants, at least four weeks, in case of bad weather more; and, therefore, consume nearly the whole time of the present quarter; after it, the soldier and the two drivers may be discharged, and the carriages and horses sold, which cannot be expected otherwise but with considerable loss.

6. The appropriation returning to the surplus fund with the end of the present week, I must take the liberty to request, that the quarter of my compensation, running since the first instant, be paid to me in advance, as I could no more receive it at the end of it. I shall, therefore, consider myself obliged to work yet all this quarter, as much as ever possible on the calculations, but cannot expect to finish all.

7. In respect to the instruments, I take the liberty to propose, that the smaller instruments, which might be of use to the War Department, be directed to be delivered into the Engineer Department. The large, and of course more delicate ones, the loss of which cannot be replaced but with great difficulty and expense, should necessarily be spared all useless transportation, which might so easy occasion their destruction. In this view, I take the liberty to propose to leave them with me, until such time as they will either be needed elsewhere for proper use, or their removal from my place of residence becomes indispensable, on account of my leaving it myself. I should then, and as relates to the present division of the instruments now, wish to agree upon the proper measures with the Engineer Department.

8. It will also be necessary to keep from the appropriation for the survey, some funds dispensable to pay the zenith seitor, which shall soon arrive from Mr. Troughton of London, for which I have forwarded him a letter of credit of 300 guineas, and other smaller things ordered to him. I expect the accessaries, of freight due, may be paid yet out of the funds requested in article 4.

I have now only to state to you, what works are yet required, in calculations, &c., to take all the advantage from my work and observations of last summer, as contained in my day-books.

1. To continue and finish the calculations of the differences of latitude and longitude, of all the points determined by the trigonometrical survey.

2. To finish the calculations of the elements of the projection, and make the projection itself on a large scale upon paper.

3. To introduce the results of article 1, upon these papers, containing the projection, so as to bring them in the state to be used in the detail surveys.

4. To calculate the altitudes over the sea of all the stations, from the vertical angles observed, as recorded in the day-books, and the level taken to the sea, at the signal in the Narrows; a work which has not been touched, having postponed it for next winter, when I expected more leisure time for it; while I considered my time better employed last winter, in bringing the work to the state of usefulness for detail surveys.

I must take the liberty, to request your speedy answer upon my above propositions, as there remains but a few days until the expiration of the appropriation would deprive of the means of doing any thing in them.

I have the honor to be, &c. &c.
F. R. HASSLER.

Hon. W. H. CRAWFORD,
Secretary of the Treasury, Washington City.

Washington, April 27th, 1818.

MOST HONORED SIR:—The President directed me yesterday, to speak with you upon arrangements relative to the Survey of the Coast in its present situation, as there is only this day allowed to act. I take the liberty to present to you the following propositions:

1. That according to the propositions made by the Secretary of the Treasury, which will lay at the President's, the whole, together with the appropriation, be transferred to the War Department this day.

2. That I be directed to deliver my work in the state it is to your Department, against receipt for the same.

3. That certain instruments, which may be of use in the Engineer Department, to be sent to the same, and the other parts remain with me until further orders.

4. That I be allowed the use of such instruments, and other means from the Survey of the Coast, now in my hands, as I shall need, and have been allowed by the President, for the mission to the northern boundary, which he has pleased to honor me with.

Any more detailed information that you may wish upon the subject, I will be happy to give, verbally or in writing, as you will desire.

It would be proper that an inquiry would be established, by a person or persons purposely charged upon the whole transaction, from the beginning in 1807, in order that it might be refreshed in the memory, with all its bearings, and the intended consequences and objects in them. I will, if you desire, make out of all the documents, and the dates of all the letters relating thereto, from the beginning, and any one that may be lost or mislaid in the Treasury Department may be replaced, in so far as it may have emanated from me, out of my collection of the same.

As this inquiry would also elucidate all my transactions for this

business, as well as the views I had in it, relative to public benefit, it would also be an object of private satisfaction to myself.

It being useless to be more lengthy here, it remains me only to assure you of my readiness for any service I may be able to render in this subject, though I might not be in case of further direct co-operation.

I have the honor to be, with perfect, &c. &c.

F. R. HASSLER.

The Hon. J. C. CALHOUN,
Secretary of War of the U. States, Washington City.

PRINCIPAL DATES OF THE SURVEY OF THE COAST.

As it may be of some interest, in future times, to refer to the transactions relating to this work, it may be proper to add to these papers the notice, by order of their dates, of the principal documents to which it has given rise, and of the success proceeding of the work itself. This public notice, given herewith, may serve to find the documents themselves if needed.

1807. *February* 10*th*. Act of Congress authorizing the President to to cause the whole of the coast and harbors of the United States, with the adjacent shoals and soundings to be surveyed.

March 25*th*. Circular letter of the Secretary of the Treasury, requesting to suggest a plan of operation for the intended work. One was addressed to me in Philadelphia.

April 2*d*. My general plan of operation for the work, (in French.)

July 21*st*. Letter of Robert Patterson, Esq., Director of the Mint in Philadelphia, informing me, in West Point, of the President's confidence in the plan I suggested; but that the situation of external relations occasioned to postpone the execution, requesting me to communicate upon the necessary instruments, in a preparatory manner.

August 10*th*. I communicated to Mr. Patterson my ideas upon the necessary instruments, the different manners of procuring them of good quality, and proposed to make plans for same.

September 2*d*. Letter of Mr. Patterson to me, proposing me, if I would go to London to direct the construction of the instruments there, as no man of this country was just there, acquainted with this subject, and requesting an estimate of the amount of the instruments.

September 12*th*. My answer to Mr. Patterson, containing the desired estimate, and announcing my willingness to undertake the mission if desired.

1811. Here the whole rested until March, 1811, when a friend of mine informed me, that Mr. Gallatin, Secretary of the Treasury, wished to know if I would yet undertake the mission to London, for the instruments; upon which, I mentioned him my willingness for it.

1811. *April 16th.* Mr. Gallatin, by the direction of the President, proposed the mission.

May 14th to 25th. Definitive agreement for the mission; the letter arriving while I was in a bilious fever; with the first recovery I worked at the plans for the instruments—base apparatus, &c.—making drawings of them in full size, upon eleven plates, (I showed after to Mr. Gallatin and Mr. Patterson,) and took with me to London, for the instruction of the artists.

July 27th. Left Schenectady for my mission, and my first compensation began.

August 1st. Arrived in New York, where Mr. Gallatin was expected, which delayed however.

August 9th, 10th, 11th. Met Mr. Gallatin in Philadelphia, and, upon his direction, agreed with Robert Patterson, Esq., about the instruments, &c.

August 25th. Mr. Gallatin approved of the instruments proposed, and gave me my instructions, passport, and a letter of credit upon Messrs. Baring, Brothers & Co., in London, for the payment of the instruments.

August 29th. Embarked on board the Armata for Liverpool.

September 27th. I arrived in Liverpool.

October 10th. I arrived in London.

October 11th. I visited Mr. Troughton, and various other artists.

November 2d to 14th. I made report to the Treasury Department of my arrival in London, and my visits to the artists; the necessity of applying to Mr. Troughton alone for the main instruments; and the probable necessity of a longer stay than contemplated, on account of his being yet occupied with the mural circle of Greenwich; entering into various other details.

December 10th. Letter from his excellency Mr. Barlow, Ambassador at Paris, promising to procure the books for which I had written to him.

1812. *January 8th.* My report to the Treasury Department, giving a detailed account of the manner in which I had distributed the work among the artists.

February 22d. Letter of Mr. Hardy, engaging definitively for the two clocks, and two chronometers.

March 22d. My further report upon the proceedings with the artists; first account upon money received from Messrs. Baring, Brothers & Co.; and request for directions in the case of a change of the political connexions between the United States and Great Britain.

May 30th. Further report to the Treasury Department.

August 24th and 26th. Further report of mine, and second account upon money received.

June 27th. Letter from the Treasury Department, directing me to remain in London until the completion of the object of my mission, political changes notwithstanding.

September 6th. I wrote again to Mr. Barlow, in Paris, upon the books to be procured in France.

1812. *September 12th.* I delivered to Mr. Russel, Chargé des Affaires of the United States in London, the chronometer of Grimaldi & Johnson, bought on the highest recommendation of Dr. Pond, Royal Astronomer.

November 30th. I reported to the Treasury Department; presenting all details of my mission, in form of a table, and sent my third account upon moneys received.

1813. *January 20th.* I applied to the Alien Office for a passport to France, to procure in Paris the standards and the books required for the object of my mission; and to care some private interests in Switzerland, occasioned by the death of my father.

January 29th to February 1st. I made all the necessary dispositions for the continuance of the concerns of my mission during my absence; leaving proper detailed directions, and power to the artists, and particularly to Mr. Troughton; and also to Messrs. Baring, Brothers & Co., relative to my credit upon them, providing for any case of accident or delay which might befall me. I gave notice of all these dispositions to the Treasury Department, and sent in my account upon the money received until then.

February 9th. I left London to ship for Caen.

March 22d. Arrived in Paris, having been much delayed by storms and formalities.

March 30th. I reported to the Treasury Department my transactions at Paris.

April 4th. Arrived in Switzerland.

April 28th. I left Switzerland again.

April 10th. The box of books, bought in Paris, was forwarded to Guernsey.

May 25th. I left Paris for Morlaix, with the standard of French weights and measures.

June 14th. Arrived in Dartmouth, where I had to wait for my passport from London; it having been refused, on the application of Messrs. Baring, Brothers & Co., made upon my request from Paris.

June 25th. I arrived again in London.

July 28th. I made report to the Treasury Department, upon my transactions on the Continent of Europe; the state of the works of the artists in London; and requested order for the case of my having to stay longer than then contemplated. I sent also my fifth account upon the money.

August 1st. Letter to Robert Patterson, Esq., Philadelphia, upon the subject of my mission.

November 25th. Letter from the Treasury Department, prolonging my stay in London, and answering the questions contained in the letter to Mr. Patterson.

December 24th. I received the two clocks of Mr. Hardy.

1814. *January 3d.* I made a detailed report to the Treasury Department, upon the state of each object of my mission, and sent in my sixth account upon the money.

February 15th. Further report to the Treasury Department.

1814. *March* 18*th.* Letter to Mr. Gallatin, in Petersburgh, upon the objects of my mission.

April 9*th.* Mr. Gallatin having arrived in London, I had frequent communications with him, upon the subject of my mission, during his stay.

May 21*st.* I moved in the house next to Mr. Troughton, to be present at the finishing part of his work. But his ill health delayed his work very much; and, with the approach of summer, I was also obliged to remove my family to the country, on account of the ill health of my children.

June 16*th.* I reported to the Treasury Department upon my mission in detail.

September 19*th.* Letter to Mr. Gallatin, in Ghent, relating to my transactions.

September 22*d and* 23*d.* Mr. Troughton divided the standard scale.

October 15*th.* My report to the Treasury Department upon the details of my transactions, and the causes of the delay.

October 25*th.* Letter to Mr. Gallatin, communicating the foregoing, and requesting his direction, or advice, upon various subjects.

November 18*th.* I set off from London to bring my family to Paris over the winter, on account of their health; and seeing the impossibility that the instruments should be completed during the winter.

December 20*th.* I directed from Paris the forwarding of the box of books, which had remained in Guernsey. I procured more books, and had the Iron Metre standarded by Lenoir, &c. &c.

1815. *February* 15*th.* I arrived again in London.

March 3*d.* Mr. Beasley told me the drafts upon my compensation, which I had sold him, had been protested by the Treasury Department.

March 10*th.* Compared with Mr. Troughton the French Metres with the Standard Scale he had made for me; when the news of the events in France obliged me to go quick to my family in Paris.

April and May. Severe sickness in my family obliged me to remain in Paris.

June 7*th.* I left again Paris for London.

June 10*th.* I arrived again in London.

June 20*th.* Mr. Dollond delivered the telescope, which he had made upon my orders for trial, having agreed with him, that I should take those I found the best after repeated trials. I took the others needed from Mr. Tully.

June 24*th.* I delivered to Mr. Gallatin, in London, a general account, upon the employment of the funds of the credit given to me; showing by estimate also, what was needed to complete the full payment of the instruments.

June 27*th.* Mr. Gallatin took arrangements with Messrs. Baring, Brothers & Co., for the payment of the government's instruments; but they refusing to advance any thing towards assisting my return, I procured the means for that upon my private credit, as

I could not sell my draft upon the Treasury Department, on account of the protest of my former draft, sold to Mr. Beasley; though this had been occasioned by circumstances foreign to me.

1815. *July 25th.* The instruments having been all packed, they were this day begun to be brought to the Custom House of London; and on the following day some boxes visited, &c.

August 1st. I informed Messrs. Baring, Brothers & Co. of this delivery, and requested them to make the insurance, according to the direction of the Treasury Department.

August 2d. Messrs. Baring, Brothers & Co. paid the balance due upon the instruments, on government's account.

August 4th. Date of my last report from London upon my mission; my last account upon the money of the credit upon Messrs., Baring, Brothers & Co., and duplicates of all the vouchers belonging to it, which I delivered the day after to his excellency Mr. Adams, Ambassador of the United States in London, to be forwarded to the Treasury Department. During all the time, I kept a regular journal upon all my proceedings, in which I inserted every detail, &c.

August 8th. I left London for Gravesend, to embark on board the ship Susan for Philadelphia.

October 16th. I informed Mr. Dallas, Secretary of the Treasury, of my safe arrival in the Delaware Bay, with the instruments.

October 22d. Landed in Philadelphia.

October 31st till December 14th. I deposited all the instruments and books of the government's collection, at the University of Philadelphia, under the care of Robert Patterson, Esq., unpacked them, and delivered them in form, as completion of my mission.

December 31st. I arrived in Washington for the first time.

1816. *January 5th.* I delivered to the Secretary of the Treasury the plan for putting the Survey of the Coast in operation, according to the desire of the President.

January 11th. I delivered to the Secretary of the Treasury the sketch of my accounts, both for compensation and balance on the instruments, and other papers relating to my mission.

January 20th. Mr. Dallas communicated to me the President's approbation of my plan, handed in the 5th instant, upon which would be acted when the appropriation, then before Congress, would pass; until that time also, the settlement of my accounting concerns was referred.

January 24th. Arrived again in Philadelphia. From then until June, I made various preparatory works, needed for the future use of the instruments, directed the construction of the stands, and made a turn to New York, with the view of preliminary reconnoitering, considering that part of the country likely the most favorable to begin the work.

April 4th. Message of the President, and report of Mr. Dallas, upon the progress for the arrangements for the Survey of the Coast, stating my return from my mission, and that the instruments had given satisfaction.

1816. *May 2d.* Notice of the Secretary of the Treasury, of the passing of the appropriation in Congress, and request to concert with Mr. Patterson upon the measures to be taken to activate the work.

May 15th. My report upon the measures to be taken to activate the work.

June 5th. I forwarded to Mr. Troughton, in London, a letter of credit, sent to me by the Treasury Department, and the order to furnish a zenith sector of six feet, which he had formerly begun for the government, and then laid aside upon counter order.

June 18th. Letter from the Treasury Department, communicating the President's approbation of my appointment, upon which various letters had been exchanged previously, and requesting me to come to Washington, to make a detailed paper upon the agreement, and to pass my accounts from my mission.

June 26th. I left Philadelphia for Washington, but fell sick in Baltimore.

July 3d. I arrived in Washington.

July 17th. I delivered to the Treasury Department the detailed articles of my agreement for the work of the survey.

July 20th. The accounts from my mission, and to the date of the new appointment for the work, were settled, and the balance paid to me. The amount of the protested draft was paid to Mr. Beasley; and the Treasury Department promised to arrange with him for the indemnification, which he claimed on account of the protest.

July 21st. I set off for Philadelphia, where I had a conversation with the Secretary of the Treasury, upon various details of arrangement; and asked if it was desired that I should begin in a certain place; which he saying to be indifferent, I proposed to begin near New York, as being most favorable in principle, which he approved of.

July 27th. I arrived at Mount Holly, near Burlington, New Jersey, with the necessary instruments for reconnoitering, and requested Major T. T. Abert, of the United States Topographical Engineers, who had been appointed by the Secretary of War as officer to assist me in the work, to come with me; but not having any funds, for the expenditures to be made on public account, he did not come with me. I proceeded therefore alone, and went to Brooklyn, requesting General Swift to send some young officers or cadets with me, for the continuance of my turn.

August 6th. I left Brooklyn with three cadets, then there in vacancy from the Military Academy, and proceeded on Long Island, to view Hempstead plains and the hills till Setauket; then passing the Sound, visited the opposite hills of Connecticut, till again to New York.

August 16th. We arrived again in Brooklyn; I received there, at General Swift's, from the Treasury Department, the President's confirmation of my detailed agreement, dated August 3d, 1816.

August 17th. I returned to Philadelphia.

1816. *August* 18*th.* I reiterated my request to the Treasury Department to furnish Major Abert with funds for the public expenditures. As I could not proceed effectually in the mean while, I took this time to move my family to Newark, N. J., to be more central to my work.

September 8*th.* I arrived in South Amboy, where Major Abert had arrived the evening before, on my request, having received funds; but bad weather interrupted all proceedings until

September 17*th.* We reconnoitered on Long Branch, Navesink, and the adjoining country till to Monmouth Court House, expecting to find a locality for a base line on Long Branch, as Hempstead plains had been found unfavorable.

September 23*d.* Bad weather interrupted this turn; Major Abert and I parted, to meet again in four days in New Brunswick, some repairs being needed at the conveyance, &c. &c.

September 28*th.* Left New Brunswick with Major Abert, and continued the reconnoitering from the Beaver dam in Monmouth county, and all the Jersey shore south till Cape May, and up on both sides of the Delaware till Philadelphia.

October 16*th.* At Philadelphia, had a conversation with Mr. Dallas, and directed the construction of the boxes for the base apparatus. Then returned to Newark, to combine the results of the reconnoitering, which giving some probability for a suitable base on Long Branch, I requested Major Abert to meet me with the wagon and horses at Mount Pleasant, and General Swift to send there two soldiers for the manual assistance needed.

November 4*th.* I left Newark for Mount Pleasant, with my son and instruments; Major Abert sent me there a light wagon with two horses, but did not come himself, for want of public funds; the soldiers also did not come. I proceeded, therefore, the third time (paying myself the public expenditures). I made an approximate survey of the neighborhood of Long Branch, with the assistance of my son, and was interrupted by a law-suit from a man, about some branches of a cedar bush, in the preceding turn, to make the rest serve as a temporary signal. This circumstance I communicated to the Secretary of the Treasury.

November 23*d.* I sent my first report upon my operations to the Secretary of the Treasury, accompanied by a letter, stating the difficulties under which I labored; requesting an ostensible paper to be given to me, to legitimate myself as acting under public authority. I requested also funds to be given to Major Abert, to enable me to reconnoitre further, under the favor of the naked woods, and to transport the necessary instruments from Philadelphia to Newark.

November 25*th and* 30*th.* Letters from the Treasury Department, forwarding me a copy of the letter of the Treasury Department, of the 3d August last, and postponing the answer upon my other requests, and the funds, on the consideration of the season for active operations drawing to a close.

December 18*th.* I communicated to the Treasury Department

the decision of the Legislature of New Jersey, to receive proposals for an accurate map of the state, and proposed certain arrangements, by which these views of the State Government could be made to concur with the Survey of the Coast, with mutual advantage, for economy, acceleration, &c., in which I had reason to believe the State Government disposed to enter, and make a law, so much wanted for the protection of my work and signals, permission to clear views, &c., presenting general views upon this subject, and requesting instructions upon it. I pressed, also, the building of an observatory, &c. To this I added a separate letter, requesting again funds to be given into the hands of Major Abert.

1817. *January* 11*th.* Major Abert wrote to me from Mount Holly, that he had received funds for the public expenditures; and I had just written to him, appointing him to meet me in Philadelphia, to bring the necessary instruments to Newark, for which I intended to advance the necessary funds.

January 29*th.* I set off for Philadelphia, for the removal of the necessary instruments.

February 11*th.* We arrived at Newark with the instruments, and I found a letter from the Treasury Department, of the 31st January, requesting me to state the probable time which will be required for the execution of this Survey.

February 14*th.* I answered the above question as well as possible, entering into various details relating to the work.

March 12*th.* I gave account to the Treasury Department on various subjects, and pressed the decision upon those of my letter of the 23d November last as indispensable, to take advantage of the first opening of the season, and deducing the reason given to the military for the manual assistance required.

February, March, until April 16*th.* The standards of the bars for the base apparatus, the comparison of them and the French and English standards, and the pyrometric experiments, were made, of all which a separate account has been given. A wagon and springs was constructed for the conveyance of the instruments, and other preparations made.

April 2*d.* In a letter to Mr. Crawford, I pressed again the decision upon the remaining subjects of my former letters.

April 12*th.* I stated to the Treasury Department the situation of Major Abert as to funds, and required what was needed for the campaign of the summer.

April 13*th.* Major Abert arrived from Mount Holly.

April 16*th* Set off on reconnoitering the Newark Mountains and the Hackensack Valley, in which the configuration of the country led me to expect a locality for a base line, which on Long Branch was too small. Such a locality was found in the Valley of the English Creek, one of the tributaries of the Hackensack.

April 20*th.* I received a letter from Mr. Crawford, of the 15th, answering my request relative to soldiers for the manual assistance, and sending me Piazzi's Catalogue of Fixed Stars, produced in Naples by Mr. Pinkney.

1817. *April 22d.* I informed Mr. Crawford of the result of this reconnoitering, the finding a locality for a base line, and what arrangement I had taken for the further work. I caused signals to be made at the projected base ends, and various other places, &c.

April 27th. I went with Major Abert to Wesel Mountain and Cranetown Mountain, which were intended for the first triangle points.

April 29th. Major Abert left for Philadelphia, and I made preparations for the preliminary measurement of the base.

May 7th. I began the preliminary measurement of the base, and the detail survey of the neighborhood of it, with the assistance of my son and two hired men.

May 17th. Major Abert joined me again.

May 20th. I returned to Newark, to work out the plan surveyed, and to attend to various arrangements for the future work.

May 28th. I returned to the base with Major Abert and my son, to make the second measurement of the base.

June 10th to 19th. I was employed in searching for proper further triangular points to correspond with the first triangles from the base; Major Abert in placing signals on Staten Island, &c.

June 19th to July 6th. Accompanied by Major Abert and my son, I continued the research, and fixing upon further triangle points on Long Island till Babylon and Huntington, placing signals where proper, &c.

July 6th. Major Abert procured from New York one sergeant, two corporals, and twelve soldiers, the necessary tents, and other equipments, for which he had been authorized by the War Department.

July 9th. Major Abert arrived in Newark with the above;—made a contract for provisioning them. During this time, I prepared all that related to the instruments and other fittings-out for the work, and made several more excursions in the neighborhood, until

July 15th. We set off altogether, with all the necessary equipments, instruments, &c. to Wesel Mountain, and encamped there in the evening.

July 16th. Major Abert left for Mount Holly, to remove his family to Newark.

August 2d. I went to New York to speak with General Swift, in order to obtain some cadets from the Military Academy for assistance, as had been agreed, and which were much needed, as I had only my son, and that at my own expense; but General Swift was absent.

August 5th. Major Abert returned.

August 6th. I again made report upon my proceedings to the Treasury Department, and joined a letter, pressing the sending of some cadets or young officers, according to the plan agreed upon.

August 25th. Left Wesel Mountain station, and established on Cranetown Mountain. Major Abert having been poisoned by weeds in an excursion for night signals, was absent on account of sickness.

1817. *September 3d.* I moved to the third station on Springfield Mountain.

September 5th. I wrote to the Treasury Department, pressing also the decision upon the junction with the Jersey Survey, and various other subjects.

September 9th. Major Abert joined again with Lieutenant M'Neill, arrived from West Point, as second assistant.

September 28th. Lieutenant Adams joined also as assistant.

September 29th. We moved to the station at the south end of the base, in English neighborhood.

October 4th. Received from the Treasury Department authorization to treat upon the junction of the Jersey Survey, upon which I wrote immediately to Governor Williamson, of that state.

October 9th. Moved to the station on Bergen Neck, where bad weather interrupted the work very much; and a view had to be cut through a near wood, to see one of the signals on Staten Island.

October 17th. Lieutenant Vinton joined the work of the Survey as third assistant.

October 18th. Lieutenants M'Neill and Adams left, to attend the court-martial in West Point.

November 8th, 9th, and 10th. Moved to the station on Staten Island, at the place where fire signals had been during the war.

November 15th. Sent Major Abert to place the signals of the verification base, near Gravesend, and various others, to join the triangulation to Long Island, south of the Bay of New York, according to the locality which he had been visiting with me in June and July.

November 27th. Major Abert returned to the station from the above excursion.

November 28th. Moved from the station to Long Island, near Fort Lewis, making successively the stations of the west end of the base, the Narrows, and the east end of the base.

December 5th and 6th. The verification base was measured by Major Abert once, and by Lieutenant Vinton once.

December 8th. Forwarded to the Treasury Department the report upon my proceedings to that day, and moved to Rockaway.

December 15th. The weather having been constantly bad, I made the preliminary calculations of the triangulation, and the comparison with the verification base, the results of which were satisfactory. There being no hopes of the weather becoming favorable again, this station was postponed, and we moved home.

December 18th. I made report to the Treasury Department upon the state and progress in the work, and sent a sketch of the triangles which had been executed; adding the information, that the coincidence of the results, the accurate calculations of which would occupy the whole winter, was satisfactory enough to allow to ground the detail surveys upon them, which might therefore be begun the following summer in the parts of the country over which the triangulation extended.

1817. *December 29th.* Major Abert left for Washington, on private business, after having returned the soldiers to their garrison, and the tents and other effects to the public stores.

1818. *January 5th.* Lieutenants M'Neill and Adams joined me again.

January 11th. I gave to the three lieutenants, Adams, M'Neill, and Vinton, now for the first time united, a written instruction upon their duty in the Survey of the Coast, and communicated the instruction to the Treasury Department.

January 12th to 18th. We made the station at Clove Hill at the north end of the base.

January 21st. Lieutenant M'Neill went to New York, and fell sick there; returned the 5th February. Lieutenant Adams was sick at home; and Lieutenant Vinton alone able to do something in calculations.

January 27th. The information from the Treasury Department to me, that an additional allowance of $1.25 had been made to the four lieutenants with me, upon proposition of the War Department.

February 2d. My answer to the above, requesting the determination of the period of the beginning, and observing that my views in proposing officers to be employed, who would besides reap instruction in the work, was also, that, as they were paid by the War Department, the Survey fund had been intended to be alleviated from all such expenses for assistance of any kind.

March 7th. Lieutenant Loomis informed me that he had received intelligence he would be ordered to report too for the Coast Survey. (He never joined.)

March 9th. The results of the geodetical observations were all brought in order at that date, so that the final calculation of the triangles was begun, and other such calculations.

March 18th. Major Abert returned; but being now in no way introduced in the state and manner of the work, and my own attendance to the calculation pressing, he could not be of any assistance, there being no time to introduce him.

April 3d. I reported to the Treasury Department the advanced state of the calculations of the work of last campaign, and that I would shortly present to him the full results, in order and brought upon paper, for the detail surveys, upon the organization of which I should make the appropriated propositions.

April 6th. Date of the Secretary of the Treasury's letter, that I should send in the results of my works without delay, and alleging, "that the little progress hitherto made in the work had caused general dissatisfaction in Congress," &c. &c.

April 9th. I received the above letter, and answered it by a small statement of facts relating to the work in its different stages, and proved how ungrounded the accusation was which had been stated.

April 11th. Major Abert left for Mount Holly on private business, and I set off for Washington in the afternoon, with all my work in the state in which it was.

1818. *April 13th.* I arrived in Washington, delivered the above letter to Mr. Crawford, and announced my presence and readiness for the delivery of my work.

The law authorizing the Survey of the Coast was repealed, under No. 58 of the session, limiting it to the sole employment of naval and military officers.

April 21st. I visited the President, and delivered to him a copy of my letter of justification, which he promised to read, and proposed to me the work of ascertaining the boundary line with Canada.

April 22d. I proposed the necessary measures for securing the station points of the work done, and the other arrangements arising from the circumstances, which being approved, I gave the proper directions for their execution to the Lieutenants M'Neill, Adams, and Vinton, and my son.

April 27th. The funds from the appropriation for the Survey were transferred to the War Department, to make it possible to continue under the modification of the law, as otherwise the appropriation would have expired that day.

April 29th. I delivered all my journals, results, and other works, to Brigadier General Joseph G. Swift, Chief of the Engineer Department, after having brought the triangles in a proper order for easy use, and took receipt for the same. That day Major Abert had also gone to Newark, dismissed one soldier who was yet there, and discharged the officers, so that these had to hire assistance and volunteer their services for the execution of the direction which I had given to them.

April 30th. I left Washington for home.

May 9th. I delivered to Major Baron, Deputy Quarter Master General, in New York, such part of the instruments and books as had been agreed upon with General Swift; the delivery of the others being postponed until my return from the boundary line next fall.

December 5th. Having returned from the boundary line, I wrote to the Secretary of War, to state my readiness for the delivery of the rest of the instruments, requesting only the loan of those which were expected to be needed in the boundary line, under the supposition then made, that I should continue in that work next season.

December 24th. I delivered the horses and the carriages to Major Baron, Deputy Quarter Master General, in New York, which were sold at auction the 31st December.

1819. *February 12th and 13th.* I delivered to Captain De Russy, of the United States Engineers, the remaining instruments, books, stands, and other objects of the collection for the Survey of the Coast, except those allowed to me as above stated.

Various letters were exchanged after this, referring to details relating to instruments, &c. &c.

F. R. HASSLER.

Newark, New Jersey, February 16th, 1820.

The following paper was read before the Columbian Institute, on the 9th of December, 1826, *by* Col. Roberdeau.

OBSERVATIONS ON THE SURVEY OF THE SEA-COAST OF THE UNITED STATES.

This matter, so important to the Government of the United States, as well as to the interests of the nation, in its various relations and results, may be justly entitled to the attention of the community, and more particularly, to the notice of the national institute here, as being intimately connected with the investigation and advancement of science; and, if an object of such acknowledged importance be passed by at the seat of Government, and within the sphere of this Scientific Institution, erroneous opinions might, and probably would attach to the omission, and its utility, by other societies of a similar character, doubted, because, in no other way than under the immediate patronage of the General Government, can any such project be successfully undertaken. For these, and other reasons that might be adduced, the subject is now brought before the Institute, in preference to any other, where a mere abstract proposition of speculative science might be substituted, and the impression of its importance will, it is hoped, be a sufficient apology. In doing this, it is not intended to enter into arguments, or minute details, which would require more mature consideration than can be now devoted to it, but merely give an outline history of what has been attempted, with such general observations as may appear to arise from it, the correctness of which is with great deference submitted to the Institute.

The survey of the sea-coast of the United States was brought before Congress, by the President, (Mr. Jefferson,) during the session of 1807, and an appropriation of $50,000, for this object made on the 10th of February of that year. The act authorized and requested the President to cause a survey to be taken of the whole of the coast of the United States, with the adjacent shoals and soundings, employing proper persons in accomplishing the purposes described in it.

Agreeably to this provision, on the 25th of March following, the Secretary of the Treasury, (Mr. Gallatin,) addressed a circular letter to several gentlemen of science, requesting their opinions individually respecting the plan to be adopted. This letter explains the objects of attention in these words:

"The President of the United States being authorized by an act of the last session to cause the whole of the coast of the United States, together with the adjacent shoals, and soundings, to be surveyed, it is his intention that the work should be executed with as much correctness as can be obtained within a reasonable time," requesting the suggesting of the outlines of such a plan, as may, in their opinion,

unite correctness and practicability. Mr. Gallatin then defines three distinct parts of which the work should consist, viz. :—

"1. The ascertainment by a series of astronomical observations of the position of a few remarkable points on the coast, and some of the light-houses placed on the principal capes, or at the entrance of the principal harbors, appear to be the most eligible places for that purpose, as being objects particularly interesting to navigators, visible at a great distance, and generally erected on spots on which similar buildings will be continued so long as navigation exists.

"2. A trigometrical survey of the coast between those points of which the positions shall have been astronomically ascertained; in the execution of which survey, the position of every distinguishable permanent object should be carefully designated; and temporary beacons be erected at proper distances on those parts of the coast on which such objects are rarely to be found.

"3. A nautical survey of the shoals and soundings of the coast, of which the trigometrical survey of the coast itself, and the ascertained position of the light-houses, and other distinguishable objects, would be the bases; and which would therefore depend but little on any astronomical observations made on board the vessels employed on that part of the work."

These three propositions were submitted for the consideration of those gentlemen to whom this circular letter was addressed, and a question respecting the difficulties attendant upon the nautical survey is also made, viz: "Can a nautical survey be made with one vessel alone? Can angles be taken with sufficient correctness from on board a vessel, so as to ascertain its position in relation to three visible objects on shore, or is it necessary that the vessel's position at the time of taking any particular sounding should be ascertained by observers on shore, &c."

This circular was addressed to Mr. F. R. Hassler, among others, who was then Professor of Mathematics at the College at Schenectady in the State of New York, a gentleman well qualified for the task, and it was replied to by him on the 2d of April following: both of which are to be found in the 2d volume of the Transactions of the Philosophical Society of Philadelphia, published in 1825.

In this reply of Mr. Hassler, he enters into a minute description of two methods, each of which may be pursued in the attainment of the object.

The first by a complete triangulation survey of the whole coast, including the determination of the latitude, longitude, and azimuths of the principal places, such as light-houses, capes, &c. The sides of the triangles to be from about 60,000 to 100,000 feet in extent, resting on two or more bases, measured with the greatest possible accuracy; together, also, with a survey of the harbors, shoals, soundings, &c. of the coast, and filling up the details of all included within it.

The second method omits the large triangulation, but retains the design of fixing the prominent points and features of the shore, by the same mode of determining by astronomical observation, their

latitude and longitude, and correcting the differences in time, by the comparison of good chronometers, the details to be filled up by smaller instruments, as circumstances might direct.

Together with this description, a plan was also submitted for putting the survey into operation, in which a prominent feature is the establishment of two observatories, which were to form the fixed points, to which the survey, and particularly the nautical part of it, should be referred, their situations were recommended to be in the State of Maine, and in lower Louisiana, "from them nearly every celestial phenomenon observable from the tropic to the arctic circle, and within about 20 degrees of difference of longitude could be observed at one or other of them; at the same time, affording the means of comparison with each other, and supersede the necessity of referring to Europe for corresponding observations." Still, Mr. Hassler observes, "that various considerations might occasion, and favor the desire of placing one of these observatories in the city of Washington, as observatories are placed in the principal capitals of Europe, as a national object, a scientific ornament, and a means of nourishing an interest for science in general. This observatory would then be the proper place for the deposit of the standards of weights and measures, which makes a part of the collection of instruments."

This plan also embraces all the details of the intended survey, the persons necessary as assistants, and their respective duties. The principal survey proposed by it, was to form a chain of triangles, with sides of about thirty miles in length along the whole extent of the coast, determining the azimuths of their sides, and the latitude and longitude of their angular points; within these, a series of triangles of about 10 miles in their sides, in order to furnish an ample number of determined points to which the survey may be referred in all its details.

From this epitome it is evident that the first method, by large triangulation, was contemplated, and preparations for it made.

An objection to this method might arise, from an imperfect knowledge of the localities of the country, which he acknowledges, and which would lead to uncertainty in the adaptation of fixed principles of action (how perfect soever in other respects) to its peculiarities. Difficulties would doubtless be interposed to the forming of a chain of triangles of 30 miles in their sides, by the intervention of canebrakes, &c. to the South, and at other places by the extensive and dense forests, with which the low grounds are sometimes covered; other impediments would probably be presented in certain parts of the country, arising from its present uncultivated state, and occasion a tardiness in obtaining the necessary correctness, and an increase of expense in the execution wholly inadmissible; Mr. Gallatin may have had this in view when, in his circular letter, he observes, that the work should be executed with as "much correctness as can be obtained within a reasonable time," knowing that Congress were to be the judges of the reasonableness of the time, as well as of the attendant expenses, and that an excess in either would endanger the success of the whole project.

Whether any or what systems were recommended by the other gentlemen to whom this circular was addressed, is unknown; but this of Mr. Hassler being adopted, the first step towards the execution of the law was to procure the necessary instruments from Europe; and he was employed, under the authority of the President, to proceed to London, and there to superintend their construction.

Mr. Hassler sailed for England on the 30th August, 1811, to perform the duties assigned to him, under instructions dated the 23d of that month, from whence he returned to the United States in October, 1815, bringing with him the instruments and books, &c. necessary to the Survey, agreeably to a list which had been prepared, and which were approved by Dr. Patterson, then Director of the Mint, in whose care they were then placed.

The cost of these instruments and books, as appears by a settlement of the account in the Auditor's Office in the Treasury, July 17, 1816, was as below:

Cost of instruments and books, procured by Mr. Hassler for the Survey of the Coast of the United States, in London and Paris, including packing, &c. . . .	$17,167 61
Compensation and expenses of Mr. Hassler in procuring them	20,382 37
Total* . . .	$37,549 98

Soon after his arrival, Mr. Hassler commenced his operations by forming a base line on Staten Island, from which a number of triangles were taken, and reported; these also are recorded in the philosophical transactions, in the account there given of the Survey, and the best results were anticipated from the well-known abilities of that gentleman; but circumstances unforeseen at the commencement of the undertaking had occurred, unfavorable to the present prosecution of it; for, in the mean time, a war had commenced and terminated between the United States and Great Britain.

Emerged from a contest which had called forth all the energies of the nation, the expenses of which were undefined, a disinclination to the promotion of science, or to improvements of this kind, very naturally prevailed; and, consequently, of all times to propose the continuance of so expensive an undertaking, how important soever in its results, this was the least propitious: but, from whatever causes, the project now appeared to want sufficient patronage, the appropriation for defraying the future expenses was withheld, and the operation ceased, if, indeed, it might properly be said to have been begun, nor has it since been renewed.

It may be observed, that at the time when this object was first proposed, and so ardently patronised by the great man who then presided over the United States, the knowledge of its usefulness was limited; and, during the preparations which were making for its

* Being a saving of nearly one-fourth of the original appropriation of $50,000.

commencement, little attention was given to explain the nature and importance of it: in the time of war, and in the disturbed state of affairs which followed, it could not have been otherwise expected, this want of proper information might have been a leading cause of the failure of the design.

It may also be observed, that when this survey was first proposed, the requisite science was rarely to be found under the immediate command of the Government; the Military Academy at West Point was not *then*, what it has since become. The corps of Topographical Engineers was not even formed, nor was the Engineer Department organized: recourse to other means was therefore indispensable to the prosecution of such an undertaking; had it been otherwise, and had the national institutions been as they *now* are, it is manifest that a different process would have been adopted, because the necessary qualifications, and all other means, are now within the immediate command of the Government.

Under these circumstances, should a survey of the sea-coast be resumed, a method, similar to the second recommended by Mr. Hassler, might be pursued, being less subject to those inconveniences and delays than the first, and at the same time sufficiently correct in its results for the purposes required. By determining the latitude and longitude, &c. of the important places on the sea board, and of certain points on the contemplated road from Washington to New-Orleans, an opportunity would be afforded of verifying both those surveys, by a comparison of each with the other, and by using smaller appropriate instruments for the details of the survey of the harbors, bays, and rivers, valuable materials for an accurate map of that portion of the country, as well as for a chart of the sea-coast, would thereby be furnished, and by running a true meridian line from some one of the given points on the coast to the Lakes, and there determining other latitudes and longitudes as well as on its course, the connexion for all geographical purposes would then be permanently established.

The great changes and improvements which have taken place in the national institutions of the United States, since the first projection of this survey, will justify the proposition, that should the work be resumed, the execution of it may, as well for economy, as to ensure its success, be entrusted to the Topographical Engineers, with the co-operation of the Navy; as to these departments, it appears more properly to belong, at the same time that they are particularly interested in the results. An accurate account and delineation of the bars, shoals, soundings, &c., without the coast, in a nautical view, appertain to the latter, the trigonometrical and topographical portions, to the former, and the astronomical observations for latitude and longitude, and other general matters to both. The number of engineers should be such as to admit of subdivision for the purpose of topographical surveys on the shore, where any such might be considered important, without interfering either with the observations, the nautical survey, or the necessary attentions to minor triangulation, meteorological observations, &c. To the command should be added persons skilled in other branches of science important to it, in order that the report

might be, in all respects, as perfect as possible, and exhibit also the geology and natural history of the different sections of the country. This method, by the subdivision of talent and attentions, would admit of despatch, and, if required, the work might be continued during the whole year, to the south in winter and north in the summer season. The annual expense would be comparatively small, and should a great triangulation of any particular parts be hereafter required, with large instruments, it could then with advantage be undertaken, as all the prominent points would be determined, and therefore no loss of time or expense would, by this method, be sustained.

Were this survey to be undertaken under a commission, or independently of officers of the army and navy, a large increase of expense would evidently be incurred, and less assurance of the perfect performance of it had, than in almost any other civil contract, where the requirements are more definite than those which this work admits of. In this case, there would be no concentration of command, or obligation to duty, other than that arising from personal motives; when the service led to places prejudicial to health, or otherwise inconvenient, disagreeable, or hazardous, obedience might, and probably would be refused, to the orders of the superior, who (be his qualifications for the work, and his ardor in the prosecution of it, what they may) is, nevertheless, dependent on the co-operation of others in subordinate stations, who have not the same impression of its importance, nor the attachment that officers have, either to the government, or for themselves, in such matters; thus, the project would be subject to disappointment in its progress, and uncertainty in the result; and, at best, no part of the survey could be adapted to military purposes, and, therefore, *in this respect*, it would be incomplete.

No nation has exerted its energies in the pursuit of geographical research more, or with greater success, than the British; the names of Anson, Cook, Des Barres, Gauld, and many others, of former times, and of Le Roy, Mudge, Parry, Sabine, Clapperton, &c. &c. of latter, will ever be recollected for their exertions, and the ability with which their explorations and surveys were directed, the latter of which, at no future period, can be surpassed. After having made accurate surveys of their own coast and harbors, their attentions were directed to the like pursuits in other parts of the world, which has continued during the boisterous scenes of war, as well as in the calmness of peace, to the present time, and they are now engaged on the same object, regardless of expense, of difficulties or danger. To that nation, and to the skill and science of its naval and military officers, to whom the direction of these explorations and surveys are exclusively entrusted, are the United States, and the nations of Europe, indebted for a greater part of the charts now in use, as well as for geographical information of the most valuable kind. The employment of officers on this service does not, however, preclude the association of others skilled in sciences connected with it; on the contrary, they are generally employed; but the command and management is confided to the officers, and they *only* are responsible, at the same time that due merit is allowed to each individual concerned in it, for their respective investigations and services.

There is, perhaps, but one instance on record of a contrary system being pursued by that government, and which occurred in the year 1698, when the celebrated philosopher and mathematician Doctor Halley had charge of the expedition, with orders, by observation to seek the discovery of the rule of variation, and to survey or explore his Majesty's possessions in North America; a brevet commission of Lieutenant was procured for him from King William, and Lieutenant Clark, of the Navy, served under him. But with all this precaution, the crew, denying the legality of his authority, mutinied, and he was obliged to return in 1699, without accomplishing the object of his mission; Clark was cashiered, but that was poor recompense for the failure of the expedition; it served, however, as a precedent in after times, for the Royal Society of London, in the year 1769, petitioned the King to fit out an expedition to the Friendly Islands for observing the transit of Venus over the sun's disk and for other purposes; Alexander Dalrymple, Esq. an eminent member of that body, was recommended to the duty: In order to obtain the proper command of the vessel, he demanded a brevet commission of Captain, in the same manner as had been formerly granted to Doctor Halley, which Sir Edward Hawke refused to sign, declaring that he would not, on any account, consent to entrust one of his Majesty's ships to a person not regularly bred to the service; on this occasion it was that the celebrated Captain Cook was promoted to the rank of Lieutenant in May, 1768, and took command of the *Endeavor*, which had been appointed to that service.

The same system has since been uniformly pursued: under it are those now engaged in pressing the explorations into the interior of Africa, and to the Polar regions; whether by land or water; be the object an extension of commerce, or the advancement of science, in every instance officers are employed.

With peculiar propriety does the same system apply to similar undertakings in the United States, and it offers the only means of acquiring practical information in the various branches of science connected with the duties of an Engineer, and which in order to attain excellence requires subdivision in the pursuit; but principally because the departure from a method universally adopted by other nations would argue a want of confidence in the talents of the officers, as well as in its national institutions, which does not exist, and thus tend to depress the spirit of enterprise so essential to the prosperity of Military and Nautical Science.

In the large armies of Europe this subdivision is made by separate corps, and embraces a certain portion of science to which the attention is principally, if not exclusively devoted. To this arrangement may be attributed in some measure the eminence to which the engineers of France have arisen, and become so important in civil or military service to their government, and in their example to the world. The institutions of the United States do not admit of such a subdivision by corps; but, yet the same principle is attended to and aimed at by the topographical engineers in their surveys reconnoissances, and by con-

tinuing this practice, a suitable classification may at some future time be advantageously made.

Connected with the survey of the sea-coast are two other important, or indispensable objects; one the establishment by law, of a Board of Longitude, and the other the construction of a national observatory.

The former is necessary to receive and regulate all matters relating to nautical and geographical science, to encourage improvements in it that may be proposed, and to authenticate such publications, as may from time to time be considered useful.

A Board of Longitude was first established in England in the year 1714, for rewarding any successful endeavors to keep the longitude at sea. It was not until 1767 that this Board first published a Nautical Almanac, which has been continued annually since, by the advice, and under the direction of the Astronomer Royal at Greenwich; the importance of this work is too well known to need animadversion. Under the auspices of this Board too, besides giving encouragement to the authors of many useful tables and other works, which would otherwise be lost, time-keepers have been brought to a wonderful degree of perfection, which would not, without this aid, have been attempted.

The connexion between this Board and an Observatory is obvious, and the duties of them inseparable, the one to furnish the necessary observations and tables, the other to employ competent persons to make the necessary calculations, and to publish authentic copies of them for general use; all others than those appointed by the Board are prohibited by the laws of the realm from editing this or a similar work.

A National Observatory is required, as well for the purpose that has been mentioned, as to ascertain by astronomical observation the geographical position of places: but a great object in this establishment here would be, by numerous observations at the seat of government of the United States, to investigate and fix, as far as may be possible to do so, the doctrine of *refraction*.

This subject, particularly as it refers to the heavenly bodies when viewed from the earth, has engaged the anxious research of European astronomers and men of science for a great length of time, without producing satisfactory results; in the inquiry is involved so many and such various properties, indefinite in their nature and effects, that no positive or distinct conclusion has yet been drawn from all the endeavors to investigate them. It has been theoretically explained, and subdivided into different terms, such as celestial and terrestrial refraction, &c.; and by repeated observations of the effects produced by weather, in various temperatures of heat and cold, clear and cloudy, attempts have been made to establish some rule or principle by which this phenomenon may be satisfactorily accounted for and fixed: but there are properties in nature beyond the reach of mathematical reasoning, and require only the attentive and constant observation of *facts*, which, when attained and acknowledged as truth, are yet inapplicable to any rules or theorems, resting solely and independently upon the principle that the result is such. Of this class may perhaps be regarded *refraction*; for no settled maxims respecting it have yet been decisively explained.

For some time past, very many observations, with reference to this subject, have been made at different observatories in Europe, particularly at those of Greenwich and Paris, but without the desired effect. Depending, as it may be supposed to be, on the peculiar state or qualities of the atmosphere, and as those qualities differ, not only in the difference of latitude and longitude, but also, at the same places at different times, when the medium is more or less dense, occasioning a greater or less inflection of the rays of light in passing through it; if there be other causes more definite, and approaching nearer to any fixed principle, the geocentric distances of those observatories are not sufficiently great to discover it by corresponding observations made there, and particularly as the same atmosphere, by this proximity of position, may be supposed to be common to both at the time of making the observations, and therefore the results, on this account also, would be the same.

But, were an observatory fixed *here*, the case would be materially different in every respect, and by corresponding observations made at Washington, so much nearer the Equator, and with the difference of nearly 77 degrees of longitude, results might and probably would be produced of a most interesting kind to the advancement of this branch of science; for, besides the geocentric difference of position, that of the surrounding atmosphere here is still greater; not occasionally so, but at most times, and particularly at those seasons of the year most favorable for observation. At such times, there are comparatively few days or nights on which the heavenly bodies may not be seen to the greatest advantage, through a medium more free from exhalations and vapor, or other impurities, that may affect the atmosphere at the places which have been mentioned.

Whatever other advantages may arise from the establishment of a National Observatory at Washington, this is of itself sufficient to justify the measure: it is due to the national character, as well as to those nations, who by their exertions have hitherto afforded the means of directing the wayward course of our mariners on the ocean, and furnished the land-marks on our shores, that some attempt be made by us to improve this essential branch of science.

Independently, however, of this consideration, it is evident that an observatory is essential to the proper success of any undertaking of this kind in the United States. Upon it the Survey of the Sea-Coast will greatly depend, as will that of the national road from Washington to New Orleans, and the proposed meridian to connect the western lakes with those of the Atlantic. To all these an observatory, as a fixed point to which they must refer, is indispensably necessary. Besides, it is the only means whereby practical knowledge can be attained by the officers of the army and navy, in this useful branch of science. To afford this opportunity is an object of great importance; without it, the talents of the nation, in this respect, never can be developed or known, but remain for ever dependent upon the investigations and intelligence of others, without the means even of verifying or correcting the differences arising from the position of this country.

That there exists here native talent abundantly sufficient for the

management of such an institution, is not to be doubted; but all energies are cramped and rendered useless for the want of a theatre on which to exercise and improve them. The necessary instruments are now in the possession of Government, and it needs but the further extension of its fostering hand, in the construction of a suitable building, to afford ample facility to the improvement of science, and the promotion of those researches which will hereafter, in their results, place the United States, in this respect also, on a level with the enlightened nations of Europe.

That this Survey must be undertaken at some time, is certain. Under what circumstances can it be more favorably done than at the present? In the full enjoyment of the blessings of peace:—when the national institutions are successfully progressing;—when a desire for internal improvement of the country so generally prevails, and science in the prosecution of it is sought for and cherished! Surely, at no future time can it be supposed that so many circumstances will concur to favor the accomplishment of this object, so important in its relations; and the more so, as they may be considered the first fixed principles on which the correctness and permanency of all geographical improvement must depend.

Washington, December 9, 1826.

[From the New York American.]

In conformity with the general and constant manner of treating me in all my connections with the Government since 1817, the Editor of the Daily National Journal has not kept his word given, to insert the paper here following before the 25th instant;—I suppose "to show the very age and body of the time, its form and pressure." It is therefore my duty to do what I promised to do in this case, namely, to insert it in another and more liberal paper. Comments every reader may make himself.

F. R. HASSLER.

To the Editor of the Daily National Journal, at Washington City.

Having seen in your paper of the 1st January, a discourse of Colonel Roberdeau, read before the Columbian Institute, entitled "Observations on the Survey of the Coast of the United States," I feel it a duty to my character, and even to the nation, to request you to insert the following remarks in your paper, at as early a period as possible, in order that they may meet the same eyes as the paper you have published.

Colonel Roberdeau has mentioned me, in the paper to which I allude, as having done something in the Survey of the Coast. But although he has been now for many years the keeper of all the instruments, books, and manuscript documents which were delivered by me to the officers appointed by Government to that purpose, and among the rest to Colonel Roberdeau himself, his statements are altogether erroneous; and I must correct them from my documents and my intimate knowledge of the facts and the subject.

Colonel Roberdeau states—that "*The appropriation* for defraying the further expenses *was withheld*, and the operation ceased, *if indeed it might be properly said to have been begun.*

It is, in the first place, incorrect to say that *the appropriation was withheld*, as will be seen from the following simple statement of facts.

My agency in the Survey of the Coast closed in consequence of an act which was hurried through Congress without debate or committee (in the House of Representatives), under date of 14th April, 1818, which enacted, *That so much of the Law relating to the Survey of the Coast shall be repealed as allowed to employ others but naval and military officers.*

The original Law did not even mention naval or military officers. Only I had in my plans proposed the use of them, as advantageous, by forming some of them in a school of practice to greater usefulness, and with a view to economy, considering them otherwise paid. The idea had not previously existed here of any part of this work being adapted to them. For this liberal anxiety of mine to take the greatest advantage of this work for the country in general, and to be serviceable to the army or navy, and to Colonel Roberdeau's corps in particular, I am now paid by his general argument, that none but military men are fitted for such a work! —!

On the 28th of April, 1818, date of the expiration of thea ppropriation for the Coast Survey, there was a large balance of unexpended appropriation remaining. By a rule in the transaction of public business in Washington, the departments, except the Treasury Department, can protract an appropriation, so as to be two years longer disposable, by having the balance paid over to the Treasurer.

That the public might not be deprived of the result of my labors, notwithstanding my interest in the work had thus been cut off in the most unjust and unhandsome manner, and by agreement with the Secretary at War, Mr. Calhoun, I announced myself to Mr. Crawford this transfer of the funds to the use of the War Department, to enable it to continue the work as the law supposed, and it was done about one o'clock that day.

Immediately after I delivered also to the Engineer Department my manuscript journals and results of calculations, and, soon after, the instruments required for the work, the books, &c. (see the duplicates of receipts.) The spring was at hand,—my signals were all standing on the respective stations. If the Department had had under its orders *only one man capable* of continuing any part of the Survey, it might have been done instantly, as indeed the repealing act required.

Nothing, however, has been done up to this day, notwithstanding

the anxiety frequently expressed for the continuation of the work. I am therefore warranted in saying, that no man of the requisite attainments does exist in either of the Engineer corps; and I may say this without affecting their character as soldiers and otherwise useful men, because *this branch of knowledge is actually neither their business nor within their reach.*

Since my papers on the Coast Survey have been published in the philosophical transactions of Philadelphia, a new light appears to have arisen to them, though my journals, results of calculations, &c. which form for them the truly essential part for the carrying on of the work, and which every man competent to replace me could not fail to understand, have been nearly nine years in their hands. But with all this aid, neither is my plan understood by the writer of the observations, nor does his proposition of another contain ideas that could be carried into effect, or show the slightest acquaintance with the subject, as every man of science in this branch will all at once see, so that I need not even enter into particulars; it administers the positive proof, that even with all my papers in hand, they are as little able to make a rational step in the work, as I have seen others trying to determine the latitude with the encyclopedia in hand, all the native talents notwithstanding.

The hopes grounded upon the capability of the Cadets of West Point for this duty, are equally unfounded. For the correctness of this position, I appeal to the Engineer Corps, and the government of the Academy themselves. The instruction of this Academy, though good, is but elementary and general; the time spent in it is too short to embrace with their other essentially military studies, this more extended and complicated one. A wide chasm remains between such a work and their studies: it does, in short, not belong to them. Another field of great detailed extent, requires all their time and exertions; because it is the essential part of their duty. Attempting to do more, or expect more than is possible, is doing or obtaining nothing that is right.

In every fully organized system of education of men for public utility in these branches, separate establishments for the different branches, superior to the elementary ones, are found necessary; and the military part is, and must be, separated from the civil part; each having its peculiar principles and sciences, must also have its separate establishments,—men, organization, &c.

Whether (in the second place) "*the survey might indeed be said to have been begun.*" Any of our military gentlemen would have apprized the public at the sound of drum and trumpet, if he had, as I have done, furnished all the plans in detail, and every idea that led in the work; superintended the construction of the instruments on my own new principles, (1) which, after fifteen years improvements in the arts, are still considered as master-pieces; proposed and executed methods of observation and calculation on new principles, mathematically demonstrated, furnished the whole organization of the details of a work of such extent, importance, and peculiar difficulties, in a manner as I will let these gentlemen read themselves, in the

scientific journals of Europe.* In truth, it is customary in civilized Europe to allow some merit to such works, because they are considered the most essential, and, in an intellectual point of view, the most valuable part of the work.

But besides this, I delivered, at the time when my operations were suspended, and I, condemned without a hearing (nor even a chance for it), to the use of the continuance of the work, and in perfectly clear order in my journals and results, ninety fully-executed triangles, and thirty more, partly done, which are leading to the further works, in all, therefore, the data or elements of 124 triangles,† grounded upon a base and a verification base, measured and verified by a coincidence more than sufficient for the topographical purpose within the limits they were to serve for the time, though the measurement with the peculiar means of accuracy, invented by myself for the use of the great extension of the main triangulation, was necessarily postponed for the next intended campaign. Latitude and azimuth determinations were sufficiently on hand to assign to this work its proper place and direction on the spheroid of the earth, &c. The state of forwardness was such, that I had already announced to Mr. Crawford, that with the beginning of spring, 1818, two brigades of officers, the one naval, the other topographical, might be set to work to fill up the details of that part of the Survey, for which I would present the proper plans of operation. It remains, therefore, with those who question whether the work was begun, to shew the public how it happened that this was not done, with all the means in hand, and the law in favor.‡

That the plan of operation which produces the most good work within a given time, is certainly the cheapest, I hope will not need to be discussed; and as a testimony of the faithfulness of my word, given in my letter of the 5th January, 1816, "to conduct it in a manner *permanently useful and honorable*," I will take the liberty to insert a letter from the very hand that drew up the Declaration of Independence, the head and character who conceived it and supported it for half a century, whose head, heart, and judgment, in both these branches of science, may be permitted to overbalance the aspersions with which I am honored from other sides.

Monticello, Dec. 3, 1825.

DEAR SIR:—Your favor of Nov. 24 is just now received, with the papers on the Survey of the Coast, which you have been so kind as to send me—for these be pleased to accept my very particular thanks. In the last volume of the Transactions of the American Philosophical Society, I had especially remarked these papers, and the processes so peculiarly accurate and ingenious, by which you had proposed to execute the Survey of the Coast. I regret much that it was not carried

* Brewster's and Rees' Encyclopœdia (circle).—See reference (1) ante, p. 48.

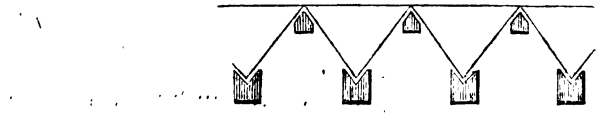
† Receipt of 28th April, 1818.

‡ My letter to the Treasury Department, of 7th July and 8th and 18th December, 1817; 3d, 6th, 9th April, 1818; to the War Department, of 27th April, 1818; and to Mr. Gallatin, 28th April, 1818.

into execution, as, independently of the permanent security it would have procured for the navigation of our coast, it would have been an honorable monument of the state of science at this early period of our history. Attentive, in every thing, to what I can find in it which may be useful to our university (now the only object and occupation of my life), I singled out your plan of an observatory, which, for its simplicity, solidity, and every aptitude for its purposes, and for its economy, presented at once what I had, for some time, thought of requesting some kind friend in Europe to procure for me. I therefore deposited the volume in the library of the university, with a note on a blank leaf at the beginning, specially referring to your plan, as suiting us exactly, whenever our institution should be sufficiently advanced to call for an observatory: we have secured a site of peculiar advantage for one in future.

There is a material part in your description, which I did not understand, and I was intending (with a request of your approbation of our adopting your plan) to have asked of you some more particular explanation of that part. Your letter furnishes the occasion of doing it now. The passage is page 148, beginning with the words "the roof over the transit," &c. to the words "cannot be described here," page 149. I do not understand this construction at all, and if you can aid me in it you will oblige me.

Permit me, at the same time, to suggest to you a construction of flat roofs different from yours. In fig. 4 you have two strata of joints, the one five or six feet above the other. I do not see the use you propose to make of the space between them. In the house in which I live, and its offices, I have flat roofs of a different construction; they consist of rooflets, thirty inches wide, with gutters between them; there are two strata of joists, the one about nine inches higher than the other, arranged thus:



A single length of shingles reaches from the top of the upper joists to half way down the gutter, which is made in the lower joists, overlapping just enough to deliver the water safely into the gutter. These gutter joists, as well as those constituting the ridges of the rooflet, have a descent of six inches from their middle point to each end, which over-jets the wall so as to deliver its water clearly over it. A floor is laid over the whole to walk on, the water first falling on that, and passing through its cracks, drops into the gutters. I have had upwards of twenty year's experience of these roofs in this house, also in one I built at another residence, and more than half our buildings at the university are flat and so covered. They never have leaked, cost less than a rafter roof, as needing no rafters, and admit repairs more easily than any others. I think it the best possible roof for an observatory.

With every wish for your welfare and happiness, accept the assurance of my great esteem and respect.

TH. JEFFERSON.

This letter may also answer Colonel Roberdeau's Treatise on a National Observatory, &c. The information asked for by Mr. Jefferson was given in my papers; this part was purposely only hinted at for brevity's sake: I stated also why a flat roof was not proper for an observatory.

I have now to notice that part of the observations which urges the employ of none but military and naval officers, on the ground that *they would never obey civil directions.* I am reluctant to believe that this be a fair statement of the views and *character of our republican military.* It is a principle of the constitution, that the military *shall be in subordination to the civil power.* The President of the United States, who can happily rarely obtain that elevation by mere military character, is the constitutional commander of the army, and can delegate this power, in the whole or in parts, as he pleases: instances of it are too abundant, and the subject not to be debated here. No officer fit for the occupation would think of such a cavil, in a work as the Coast Survey *was:* nor is there, in the obedience to scientific directions, any thing that could derogate to the highest military character.

The instances which have been adduced in support of this position are very unfortunate. The errors, both in the principles and in the results, of the British Survey, have been for many years subjects of papers in their own philosophical transactions, (see the papers of Mr. Rodrigues, Dr. Tiark's, &c.) and elsewhere. Since the death of General Roy, the character of the work has changed; and the official inquiries made by order of the House of Commons, in 1810, have, by the report (which I brought from London, and which lies in the War Department, though it is my property), shown what I think would, in this country, dispense a military chief of all further troubles in such a work. In all other countries where such works have been well executed, the schemes originated, and the direction was in the hands of civil men of science, who often had officers under their command. In France, Cassini, Delambre, and others. In Denmark, the astronomer Bugge. In the north of Germany, Zack, Gauss, &c. &c. When I accompanied my friend Professor Bohnenberger, of Tubingen, in his triangulation of the map of Swabia, under the patronage of the Archduke Charles of Austria, in order to join his triangulation to mine in Switzerland, he had under his orders an Austrian nobleman, a Captain of Engineers, with other military assistance, who was far from finding a degradation in obeying even a civilian man of science. I might even prostrate, by British examples, those unsuccessful ones, which were quoted to support the *unconstitutional assertion.* But so much is true, that blind, and even ignorant, obedience and strict discipline may suffice for common military purposes, while in a scientific work only actual zeal and scientific interest for the object in view, decide the fitness of the man: *ideas of private interest, false honor and pretensions, are, in their nature, foreign and directly inimical to such a work, and do not even occur to the man fit for it.**

* For my own experience in this particular, see my letter to the Treasury Department, of 6th August, 7th September, 8th December, 1817; of 2d February, 18th March, 9th April, 1818; and to the War Department, of 14th February, 1819.

I owe here an account of the origin and my connexions and agency in the Survey of the Coast. I arrived in this country in October, 1805, having relinquished my public stations in my native country, Switzerland, foreseeing the turn of political events, which have since come to pass, and from a predilection for a rural life, with completely different views, and means quite sufficient for them, but which I have still to claim. Having landed in Philadelphia, the late Professor Patterson, Mr. Garnet of New Brunswick, and several other gentlemen, on seeing the books, mathematical instruments, &c. I had brought with me for my private enjoyment, were so kind as to show me some attentions. I had occasion to show them, in conversation, by the scientific publications of Europe, that I had been engaged in an extensive survey in Switzerland, which was interrupted by the revolution. Professor Patterson sent to President Jefferson an account of my former life, which I furnished at his request; and Mr. Clay, the representative to Congress from Philadelphia, before setting off for Congress, in 1806, asked me if I should be willing to undertake the Survey of the Coast, to which I assented.

The law authorizing it passed in that session (10th February, 1807). I received one of the twelve circulars addressed to scientific persons, requiring plans for carrying it into effect. Thirteen plans were received by the Treasury Department.* By President Jefferson's directions, a commission sat upon them at Professor Patterson's, in Philadelphia, formed of the other gentlemen who had given in plans. In rejection of their own, they recommended mine to the President, and Professor Patterson informed me of this by direction from President Jefferson, under date of 21st July, 1807, (to the Military Academy at West Point, where I had been appointed Professor in the interval,) adding, that the execution was for the time suspended, on account of the aspect of politics, but requesting me to propose the necessary instruments and other details, which I did, and interchanged several letters.

My mission to London for the instruments did not take place until August, 1811,† when I resigned the certain and respectable position of Professor of Mathematics and Natural Philosophy of Union College, Schenectady, to, as I thought myself honorably bound, embark in the execution of my plans for a work, in which the disagreements and the pecuniary losses have exceeded by far my compensations.

Shortly after my arrival in London, the war broke out; I was there four years, under the disagreeable situation of an alien enemy, and by the neglect of the Treasury Department left two years without compensation—my drafts for the first of them having been protested, on the plea *that the endorser bought them with the government money*, being greatly indebted to it. He and I returning to this country nearly at the same time, I having faced all my expenses by my private means,‡ the drafts were paid to him in cash—my note for indemnity left in his

* Circular of 25th March—my answer, *Philadelphia*, 2d April, 1807.

† My instruction is of 23d August; my passport from the Department of State, of 19th August, and from the British Envoy Extraordinary, Augustus John Foster, of 25th August; my letter from on board the ship Armata, at sea, 30th August; from London, 17th October —all 1811.

‡ Accounts of 20th November, 1815; of July, 1816; and my letter of 11th June, 1816.

hands, he began a law-suit against me for it, though I had actually still to claim a balance upon him, the Treasury Department left me unsupported, to shift for myself, notwithstanding the previous promise of Mr. Dallas.* It was not until August, 1816, that the *contract* with me, to undertake the execution of the work, was concluded, (which for good reasons I had preferred to an office-like appointment).† I entered upon the work immediately by the absolutely necessary preliminary steps of reconnoitering, and again at my charge for all expenses, &c., as the funds appropriated to the public part of the expenses, by agreement with Mr. Dallas, were refused by Mr. Crawford,‡ and the same was the case several times afterwards. To relate the other difficulties in my way would detain me too long—the ample correspondence between the Treasury Department and myself gives the account of them.

The result in general was, that, though several young officers were detailed, and received extra pay, as attached to the work of the Survey, no angle was observed, and no calculation made for actual use, except by myself. My principal assistant was my son, who received no compensation, and an intelligent man, whom I had taken into my house, and paid at my expense.

In this way I pushed on, by forced exertions, and to the loss of my health,§ to present, to persons totally unacquainted with such works, who always expect more than is possible, a mass of results, which I feel perfectly safe in saying, exceeds what has ever been done in the same space of time in any similar work whatever. The collateral experiments necessary for such a work, are numerous, require time, reflection, care, &c. &c.,‖ and the expenses of them were borne by myself. How many other works attend such an undertaking in the beginning, which do not appear in the ultimate results, is sufficiently known to men of science. All that was rewarded by my being charged, "*that the little progress hitherto made in the work has caused general dissatisfaction in Congress,*"¶ which I thought even ignorance and malevolence united could not dare to prefer, though Colonel Roberdeau reproduces it in other words, and which I answered instantly.** If that had been the case, how could I, at a sudden, unexpected, interruption of the work, have presented a full, ordered, systematic mass of work, ready for use, and in good order.

I invite competent men or *authority* to a full perusal of all the documents. But I must decline being judged by the report of the Treasury Department to Congress, because the documents are *mutilated;* and even the *compensation* of my manifold *pecuniary losses,*

* Contract signed by Mr. Dallas, 3d August, 1816; my letter of 11th June, 1816.

† Letters of the Treasury Department, of 13th September, 1817; of 18th July, 1816; my letter of 16th October, 1816; of Messrs. Barings to me, London, 28th June, 1815, and others.

‡ Letter of the Treasury Department, 30th November, 1816.

§ My letter of 3d April, 1818.

‖ My papers in the two volumes of the Philosophical Transactions of Philadelphia, and the reviews of them, London Quarterly Journal of Science, Revue Encyclopedique, &c. &c.

¶ Letter of the Treasury Department, 8th April, 1818.

** My letter to the Treasury Department, 9th April, 1818.

in my connexions with the Government, *would by no means be an injustice.* In concluding, I feel it my duty to refer to a fact in relation to national civilization and improvements, as shown by the universal history of mankind. The nation that shall exclude from itself the admission and use of foreign talents and knowledge, must always remain behind in the paths of civilization, and will appear comparatively barbarous, if not really become so. Sciences, arts, and ideas for improvements, are the common property of all nations—their mutual ties—and can not be successfully cultivated without free intercourse, exchange, and intermixture.

It is surprising to hear a contrary assertion promulgated in the United States, (as the writer of the "Observations" does, by the over weight which he claims for his native talents!)—in that country, that ought to be adduced as the most striking instance of the truth of that principle. Every civilized nation of Europe has contributed its share to that happy mixture of knowledge and ideas of improvements, that has caused the character of this country to rise to so high a standing. I do not hesitate to assert, that the continuance of this intermixture is essential to its future progress, and, I may add, vitally important to its existence as an independent nation.

F. R. HASSLER.

New York, January 8th, 1827.

Mr. Hassler, whose answer we this evening insert, to what he conceives an attack upon his professional skill and character, made by Col. Roberdeau, of the United States Engineers, through the columns of the *National Journal*, is a gentleman of the highest attainments in mathematical science, and who has, as it seems to us, been at least harshly dealt with by the Government.

An ACT to repeal part of the Act entitled, "An Act to provide for Surveying the Coasts of the United States"

Sec. 1. *Be it enacted*, &c. That so much of the third section of the act, passed the tenth day of February, one thousand eight hundred and seven, entitled, "An Act to provide for Surveying the Coasts of the United States," as authorizes the employment of other persons in the execution of the said act than the persons belonging to the army and navy be, and the same is, hereby repealed.

Approved: April 14, 1818.

Montpelier, December 3d, 1825.

DEAR SIR:—I have received your favor of November 25th, with a copy of the papers relating to the Survey of the Coast, for which I return my thanks. Not being able to bestow on them a critical examination, I must infer, in part, the merit of what has been done, from the scientific and other qualifications, a confidence in which led to your selection for the important work. With an expression of my continued esteem and respect, I pray you to be assured of my best wishes.

JAMES MADISON.

F. R. HASSLER, Esq., New York.

Translation from the Bulletins des Sciences of Paris, of 1826, *vol.* x, *page* 207, *part Plans and Charts.*

Papers on various Subjects connected with the Survey of the Coast of the United States, by F. R. Hassler, &c.

These papers which form the greatest part of the second volume, in quarto, of the American Philosophical Transactions for 1825, are composed of different parts, which we shall here analyze.

1. A letter of Mr. Gallatin, Secretary of the Treasury, requesting the solution of several questions relating to the Survey of the Coast, and the soundings. It is proposed in it to determine, by astronomical observations, the true position of the most remarkable points; then to unite these points by triangulations; lastly, to take the soundings of the coast, and particularly those of the ports.

2. An answer of Mr. Hassler, which passes under review the principal difficulties of the subject, and indicates a series of operations, as well geodetical as astronomical, proper to fix the situation of the most important points of the coast, and especially of the light-houses and the high grounds. As this discussion is entirely conformable to the principles adopted in geodesy, it would be useless to quote here the processes proposed by Mr. Hassler, which are entirely those in use,—at least, so far as localities do not oppose; and it appears from this letter, that Mr. Hassler, having but shortly before arrived in the United States, could not yet foresee and determine these difficulties.

3. The same scientific man furnishes afterwards a general plan of operation for the Survey of the Coast of the United States. He proposes to build two astronomical observatories, the one in Maine, the other in Lower Louisiana, in order to observe all the celestial phenomena, both of the arctic and the tropical regions. These two observatories would be the points of departure of the general operation, which would thus rest upon perfectly fixed points, and of which the republic would afterwards derive great advantages, either for

navigation or for science; they would be the residence of permanent astronomers, having in charge from the Government to accomplish all the public functions, having reference to the applications of all the most approved methods of astronomy to geodetical as well as astronomical operations. Proper measures for the measurement of base lines were then to be procured, and the effect of the temperature upon their length ascertained. The country should be explored, to find a proper locality for a base line. At the same time, a chain of triangles should be extended over the whole coast, of which the sides would be about thirty miles; and besides the angles, the azimuths of their sides would be measured, and also the latitudes and longitudes of a number of points. Other triangles of a secondary order, the sides of which would have about ten miles, would be determined within the first, in order to determine a sufficient number of points for the topographical survey. Mr. Hassler indicates the instruments necessary for those operations, and indicates the principles of subordination to be established between the different engineers to be employed, in order that no opposition should create difficulties in the work.

4. Then follows the catalogue of the books and instruments procured for this geodetical operation, as theodolites, repeating circles, reflecting circles, artificial horizons of mercury, magnetic needles, transit instruments, standard bars to measure the base lines, the French weights and metres, chronometers and astronomical clocks, large achromatic telescopes, micrometers, barometers, thermometers, &c.; lastly, various French and English works relating to astronomy and geodesy.

5. Mr. Hassler gives a very detailed account of the standard length measures which he has made use of: the first is an iron metre, standarded in Paris in 1799, in presence of Mr. Tralles, then Deputy from Switzerland to the Committee of Weights and Measures, and which may be considered as perfectly authentic, as it has been verified by the Members of the Institute of France: the second is an iron toise, made by Canivet, and standarded in 1768 upon that of Peru, at the temperature of 16° Reaumur; the double length of the pendulum under the equator is marked upon it, because at that epoch, Dionis Dusejour proposed this length, in preference to the arc of the meridian, for the unit of length measure: the third are copies of toises of Laland, which have been compared in 1765 to Bird's scale: the fourth a brass metre, standarded by Lenoir, and compared by Messrs. Bouvard and Arage, in 1813, with the iron metre of the Observatory of Paris, and which was found too short for 0.01 of a millimeter: the fifth an iron toise of Lenoir, standarded by Lenoir, and which the same astronomers have acknowledged as exactly of the same length with that of Peru: the sixth and seventh, two brass metres, not compared to that of the Observatory—(*this is a mistake*): the eighth, a brass scale of Troughton, of eighty-two English inches, divided into decimals, upon a strip of silver inserted in its whole length, bearing the arms of the United States. To this scale is adapted an apparatus to compare length measures, described in Nicholson's Journal. This apparatus has served to compare all the length measures together, and with the

standard of Sir George Shuckburgh, upon which all the English toises (fathoms or double yards) are regulated.

The paper gives the description of an instrument proper to draw upon a straight line exactly perpendicular to its length. It is not possible to analyze this part of the work.

Then follow all the details relating to the comparisons of the various measures—the cares that are necessary to dispose properly the comparing apparatus, to determine the temperature, to avoid that the heat of the body of the observer could alter it.

It is certain that this operation has been conducted with great precaution and real talent. The various numerical results are given in the paper, with those of Pictet and of Kater; the consequences which are drawn from these comparisons deserve to be given.

6. These different results prove that all the metres standarded are somewhat shorter than the original which has served as type for them; because when they were worked, whether by filing or by grinding the extremities, to reduce them to the proper length, they have unavoidably taken a certain degree of heat, which has lengthened them, and has not yet entirely disappeared at the time of the comparison for the standarding; the metre being made equal to the standard under those circumstances, becomes too short when it is completely cooled down.

Mr. Hassler describes his apparatus for measuring the base lines; he states that he had means to obtain multiples of the metre, such as it results from the measurement of the twelve degrees of the meridian measured in Europe. He will elsewhere give an account of this. His bars were eight metres in length. The author explains with what care he has fulfilled the four following conditions.

(1.) To determine with precision the length of the bars used as units in the measurement.

(2.) To make that at the beginning of the end of the bars coincide exactly with the beginning point of the base line,

(3.) To orient it in a certain direction.

(4.) To ascertain the inclination of the bar to the horizon. The apparatus used in these operations are described, and the figures given in the plates.

7. There is a description and a drawing of a theodolite of two feet, used in the observations; details upon the use of this instrument, and the means to avoid all possible errors.

8. The author then explains the system of the signals he used, and the mechanism of the wires of his telescope. He rejects vertical posts and truncated pyramids, which he considers as offering deceiving phrases. He prefers a gilt globe, which adapts very well to the angles of elevation. He employs also truncated cones of sheet tin. These cones, of about twenty inches high, are placed with their axes vertical upon a vertical post; they appear as luminous points, at thirty to forty miles distance.

There are also some additions to the telescope described.

9. The description of the adjustments of the repeating circle, and of the methods of observing a series of vertical angles to determine the level. The author makes use of the reflection of the stars upon a

mercurial horizon to ascertain the verticality of the revolution of the telescope. He views directly to the pole star, then to its image in the artificial horizon, and if the telescope in its motion meet the two objects exactly upon the central wire, the telescope revolves in an exact vertical. The levels of the instrument must be adjusted so as always to give this position when the column is vertical.

10. The method to ascertain the exact time, and regulate the chronometers. The author uses the method of single altitudes, which, if made with care, and corrected for the refraction, and, if necessary for the parallax, give the time with great precision, by resolving the spheric triangle formed by the celestial body, the pole, and the zenith, of which the three sides are known; but the celestial body must be near the prime vertical. Taking six or twelve successive observations, the precise time of observations is written; the mean of the time corresponds to the mean of the altitudes, or at least only a small correction is made by the method of Mr. Soulnier.

11. The author gives the description of a repeating theodolite of one foot diameter, and the method to observe horizontal and vertical angles with the same.

12. The description of a repeating circle of reflection, and the method of observing with it—that of a plane-table and its alidade with telescope, to survey the details; lastly, that of a magnetic needle. We pass rapidly over these subjects, which would not be analyzed without the assistance of figures.

13. Mr. Hassler gives details upon the peculiar construction of the transit instruments of Troughton, and of the clock destined for the observatory. The telescope is excellent; the axis formed of two truncated cones, thirty-three inches long; the axis ends are of bell metal, and their pression is eased by counterpoises; the wires are illuminated through one of the arms of the axis; there are screws to place the axis horizontally and in the meridian as usual. The alidade, to indicate the elevation of the telescope, is placed upon an ingenious apparatus which we cannot here explain. To distinguish well the meridian mark, which is commonly not very distant, it has been proposed to add a second object glass before the telescope to procure a distinct image of it. Mr. Hassler prefers to place before the object glass an additional tube, with a diaphragm of an opening of only half an inch, which, according to him, will cause the mark to be seen distinctly, without any hindrance from the loss of light. The clock is of Mr. Hardy. Mr. Pond, who has observed it carefully, has not found half a second variation in its daily rate. The scapements, holes, &c., are of rubies; the scapement is new, and of the invention of Mr. Hardy; the pendulum has a spring suspension, and its supports are immovable; the compensation is made by a column of mercury, seven inches long and 1.9 inch diameter, inclosed in a glass tube, which forms the lens of the pendulum.

14. Then comes the plan of the proposed observatory to be built at Washington, with various remarks upon the principles of its construction, of the trials to put the instruments to. These subjects give no particular occasion to analyze.

15. Lastly, the papers conclude by details upon the organization of the operations in large geodetic surveys, and the application to the Survey of the Coast of the United States,—then tables indicating the manner of registering the daily observations.

These papers, nearly 200 pages in quarto, are of very great interest; they present few new ideas, but the details are extremely well made: they prove the work of a very learned and well-exercised engineer, who knows perfectly all the geodetical methods and the methods of observation, who knows their difficulties and defects, and has diminished the causes of error, and given to the results all the precision possible. This work does honor to Mr. Hassler, and places him in the first rank of geographers.

FRANCŒUR.

The corrections of these papers, published separately by the author, are a table of errata that have slipped in by effect of the distance of Mr. Hassler from the place of printing.

We have besides received the *New York American* of the last Jan. 1827, containing a defence of Mr. Hassler against the Observations of Colonel Roberdeau. Mr. Hassler enters in it into details relating to his life and his works. The author, born in Switzerland, where he has also made trigonometrical observations, came to the United States in 1805. Of a dozen of plans presented to the Government for the Survey of the Coast, his was preferred, and the execution committed to him. Mr. Hassler went to England to procure the instruments, and was there four years as an alien enemy—made a great deal of preparatory work—spent much money—and, notwithstanding that, it appears that he is refused to continue the work at public expense.

D.

Translation from the Révue Encyclopédique of Paris, 1826, *p.* 335.

(In the Review of the Philosophical Transactions of Philadelphia.)

The largest paper contained in this volume is a collection referring to the trigonometrical Survey of the Coast of the United States. This great undertaking was projected in 1807, before the Floridas were detached from the Spanish dominions and enclosed in the United States, which augmented considerably the extent of the coast. The beginning of the work was retarded by the intervening war, and only in 1816 could it be begun.

The instruments had been procured from England and France: it appears that the artists of the United States do not yet construct them with sufficient accuracy. It was also from England and France that the books, the tables of logarithms, nautical almanacs, &c. were procured, which were to be given into the hands of the young officers that were to co-operate in this work. The instruments are described,

and drawings in perspective given of them. This kind of drawing, in which the dimensions are altered, is not that which fits the best for the description of machines. These descriptions, even, are nearly useless; their insertion could have been dispensed with. The method indicated to fix the position of sounding at sea is pretty elegant, though less expeditious and exact than that used by Meunier to determine with the greatest precision the figure of the bottom of the Bay of Cherbourg, for the establishment of the cones which made a part of this open bay.

There is in these papers an excellent one upon the comparison of the French and English standard measures of length, sent from France and England, and the verification of their length. This delicate operation was made with all the means that can afford the best instruments, the science of natural philosophy, the methods of calculation, work and perseverance can furnish. The details must be read in the paper itself; a short analysis would give but an imperfect idea of it. The author of the paper is Mr. Hassler.

Mr. Gallatin was directed by the President of the United States, in 1807, to consult this man of science upon the means to execute the intended Survey. The correspondence relating to this subject is in the beginning of the papers, and presents a very methodical and clear summary of the work.

[Remark.]—There are many oversights and mistakes in these two reviews, but it would be too long to enter into details.

Translation from Mr. Schuhmacher's Astronomical Journal, (Astronomische Nachrichten,) Hamburgh, No. 137. *On the plans, arrangements, and methods, proposed and used by Mr. F. R. Hassler, with a view to an accurate Survey of the Coast of the United States, by the Chevalier F. W. Bessel, Professor in the University of Königsberg. (Communicated to the New York American by Professor James Renwick, of Columbia College, New York.)*

In 1807, Mr. Hassler, then residing in Philadelphia, was requested, on the part of the government of the United States, to furnish a plan for the survey of the whole coast of that country. This was done in a letter to Mr. Gallatin, which exhibits great knowledge of the nature of such operations. It is evident from it that the survey was to have been a work of great extent, and such as should satisfy the requisites both of geography and of navigation.

In consequence of this plan, Mr. Hassler went to England, to procure the necessary instruments, &c. A most complete apparatus was brought together, consisting principally of instruments constructed upon Mr. Hassler's own ideas; and in the year 1816, the operation

itself began. It appears to have been interrupted soon after, and therefore not to have given the expected results.*

But Mr. Hassler describes his arrangements and methods in a paper, which has also been printed, as an extract from the Philosophical Transactions of Philadelphia, which contains so many new views in relation to instruments, that I believe I shall make an agreeable communication to the readers of this journal by an extract from this paper, which has probably not become very extensively known (in Germany). Mr. Hassler appears in it as a man who would rather think for himself, than imitate others, and whose arrangements, therefore, always bear an independent character.

It is to be lamented, that circumstances should have occurred which prevented the complete execution of the work. To judge from the contents of the publication, not only complete success in reaching the intended object would have been obtained, but also many other useful results.†

According to Mr. Hassler's plan, two observatories were to be established, one in Washington and one in New Orleans;‡ these were calculated, not only for the purposes of the survey, but also to subserve the general objects of astronomy. Of the observatory for Washington the whole plan is given, which appears to me very appropriate: it recommends itself by a minute attention to all that can secure the accuracy of the observations; we miss in it none of those arrangements which on this side of the Atlantic have been made in the most modern observatories; in its special arrangements, this observatory often agrees with the most modern one in Germany, that of Altona.§ The instruments are a *transit* of five feet of Troughton, a *clock* of Hardy, an eighteen inch *repeating circle;* there were also to be placed in it finally a *zenith sector* and a *meridian* (mural) *circle*, &c. I cannot describe the building in detail, but I will remark that it was to be surrounded by a ditch, in order the better to avoid the oscillations of the ground by the passage of wagons, &c. The pillars of the instru-

* The suspension of the operations for the Survey of the Coast of the United States, begun in so admirable a manner by Mr. Hassler, may be considered as a national misfortune. It is such in truth; not so much from the loss of the previous expenditures, in consequence of the delay, or from the deferring of its advantages to a future period, as from the fact, that the principles and methods proposed, and some of them actually used, by Mr. Hassler, were in advance of the science of Europe at the period. As these principles and methods require the highest proficiency in mathematical and physical science, their application to practice originally in the United States, would have redounded to the national honor.

† The opinion thus expressed by Mr. Bessel is praise of the highest description; for no man has ever stood higher as an astronomer than that distinguished professor.

‡ According to Mr. Hassler's original plan, one of the observatories was to have been established in the State of Maine, near the north-eastern frontier, the other in Louisiana, near the south-western boundary of the United States. Circumstances led to the choice of Washington for one; the exact place of the other, although it must have been near New Orleans, was not decided.

§ The close coincidence between the plan proposed by Mr. Hassler for the observatory at Washington, and that erected under the superintendence of Schuhmacher at Altona, is very remarkable. This last is unquestionably the best in Europe, as well as the most modern. Mr. Hassler's plans were presented to our government in 1816; but his papers were not published until 1826. The observatory at Altona was finished in the last named year. Thus it appears that these two astronomers deduced from obvious principles two plans of the closest similitude, each without any knowledge of the other's proceedings, while the American project is prior in point of date by several years.

ments were to be placed upon solid bases six feet thick, standing in a cellar of five feet in depth, and to pass through the floor of the observatory, which was to be supported independent of them. The axis of the transit is thirty-three inches long, which also corresponds to the views of Reichenbach, who considers long axes as not advantageous; the cylindrical parts are of bell-metal, as usual with the English artists. The supports are not between the pillars, but upon them; a strong metal plate is fixed upon the middle of the pillar, bearing the parts which move the Ys, and these are moved in the direction of the meridian by screws, by which the adjustment to that direction is made; the usual vertical screw is not in the arrangement; instead of this, the piece bearing the Ys is formed like an arch, the middle of which is supported by a screw, the higher or lower position of which elevates or depresses it by the different degree of tension of the metal which is produced by the action of the screw and its own elasticity. This method promises to secure complete stability; but it is supposed that the two pillars have the same altitude, and also that no remarkable change should take place in them. The counterpoising apparatus is placed about five inches from the end, and consists of springs, which press rollers under the axis, performing what Reichenbach effects by levers and weights. By Mr. Hassler's arrangement, this counterpoising apparatus occupies the place on the pillars which the supports formerly did: this arrangement likewise appears to me good; whether it would be applicable to very heavy instruments, remains still to be tried.* The two conical axes are not joined by a cube in the centre, but by a zone of a sphere of eight inches diameter, to which the two parts of the telescope-tube are screwed: this arrangement is made with a view to greater stability.

Of the other instruments of Mr. Hassler it will not be possible to give an adequate description without drawings; but I may, however, indicate some of their peculiarities. The theodolite of two feet, not constructed for repetition, appears to me to possess a peculiarly good construction. From a hexagonal centre-piece emanate six horizontal conical arms, whose bases are three inches, and ends one and a half inch, in diameter. Upon these arms the two feet horizontal circle is made fast: three of these cones are longer; these contain at their ends the screw-work for the stands by which the instrument rests upon three vertical cones of brass fastened to the wooden stand of the instrument: between this and the six horizontal conical arms there is room for the verification-telescope, which has precisely the arrangement of a transit, and hangs in its Ys, which are fastened underneath to two opposite radii. This telescope has no lateral motion, but the wires in the focus are directed by means of a screw to the object which is taken as the point of comparison during an observation. In the same hexagonal centre-piece is fastened the vertical axis, eleven inches long, and two inches in diameter. Upon this revolves a drum, nine inches in diameter, and five and a half inches high; upon the upper surface of this

* The transit of the observatory at Greenwich is adjusted in this manner; and, as it is ten feet in length, the doubt whether the plan be applicable to large instruments, is settled by actual experience.

stand two columns bearing the Ys for the transit-telescope, by which the observations are made; this is a complete transit, and the columns are sufficiently elevated to allow its passage through the zenith. The horizontal angles are measured by the revolution of this upper part of the instrument upon the vertical axis, and are read off by three microscopes, which are fixed at the end of as many conical arms coming from the central drum, each having a micrometer-screw. The illumination is made through the axis of the telescope, the one side of which is perforated; the other has an altitude-circle of six inches diameter. The axis is about twelve inches long; which is more than the interval between the columns. Its supports are therefore set upon pieces of brass, elevated above the columns, and extending outwards: they have the same kind of vertical adjustment as the large transit described above.

In relation to the observations with this instrument, Mr. Hassler properly remarks that the eccentricity is equally corrected by means of three equidistant readings, as by two, four, and so on; he also shows that when the vertical axis is not perpendicular to the plane of the horizontal circle, the errors of the angle will be corrected if the position of the instrument's place is alternately changed to the three truncated cones of the stand, so as to give the three regularly succeeding positions of a full revolution. These three observations, each made in the two diametrically opposite positions of the telescope, and by a half revolution of the instrument, give a mean which is free from eccentricity, from any error arising from the inclination of the circle towards the axis, or from any inequality in the supports of the axis; the readings being besides made upon twelve different parts of the division. This two feet theodolite is very properly considered as the main instrument for the survey. For the other observations, repeating circles of eighteen inches, repeating theodolites of twelve inches, and repeating reflecting circles of ten inches diameter, smaller theodolites, needles, plane-tables, &c., are provided. To the most of these instruments Mr. Hassler has given a peculiar construction; but it would be too long, and perhaps without figures not sufficiently intelligible, to give a description of them here.

As signals Mr. Hassler employed truncated cones of block tin, about nineteen inches high, seventeen inches in diameter at bottom and fourteen at top; these were erected upon poles eight feet high, and rendered the best service. At a distance of about forty (English) miles they appeared as a luminous point when the sun stood so that the rays of it were reflected towards the observer; and this reflection lasted during a sufficient length of time. At shorter distances the light was so strong that a dark glass was often required for the observation. Here the same principle is made use of which in Mr. Gauss's heliotrope produces such a decided effect; but the advantages of the different arrangements are very unequal; because the cones of Mr. Hassler do not constantly reflect an image of the sun to the observer, while the heliotrope is constantly kept in the proper position to produce this effect. If the angle of the cone is represented by $2m$, then the cosine of half the azimuthal angle, when light shall be reflected to the observer, must be equal to

the sine of half the sun's altitude divided by the sine of *m*. This would take place only during a moment if the sun had no diameter, and, generally speaking, one signal would be invisible when the other is visible; but, as *m* is only a small angle, (in the cone used by Mr. Hassler it is only 4 deg. 58 min.,) and as from the altitude of the sun, on account of the magnitude of its disk, two limits may be accepted, which are at 32 min. distance from each other, the azimuthal distance corresponding to the altitudes of the sun, which admit of a reflection to the observer in a direction nearly horizontal, has a considerable magnitude within these limits; it, therefore, can have rarely happened that both the signals needed for the measurement of an angle could have shown at the same time an equally well reflected image of the sun: it seems, therefore, that the use of these signals might rather be recommended in particular cases than generally. However, Mr. Hassler says that even without the direct light of the sun, they also rendered good service, and were visible at great distances.*

Mr. Hassler has also communicated his methods for the comparison of the standard measures of length, and the results of their application; we gain by this a new comparison of the French and English measures, which I shall quote more in detail. There were three metres present: one of iron, which was one of those made by the committee of weights and measures in Paris, 1799, and distributed as authentic among the foreign deputies; the two others, the one brass the other iron, were of Lenoir, but not compared directly with the original; they, therefore, were not considered as principal in the results of comparison. These metres were compared with a scale of Troughton of eighty-two inches in length, divided upon silver to tenths of inches, to which is added a micrometic apparatus to take off measures from the scale. Instead of the usual method in comparing a metre *à bouts* with one *à traits*, (to place butting pieces with lines drawn near to the end of them, the distances of which are measured by the microscopes when these pieces are laid together,) Mr. Hassler employed the end planes themselves; for that purpose he constructed the butting pieces exactly of the same thickness as the metres, and obtained, by the close juxtaposition of both, a line, which presented itself like a division-line of the scale. By means of several experiments, (reduced to 32 deg. Fahrenheit, and adopting the expansion of the iron and the brass as Mr. Hassler determined it by his own experiments: namely,

* To use the heliotrope two conditions are indispensable: the attendance of an assistant at each signal-station to direct it to the observer, and its actual illumination by the rays of the sun. Had Mr. Hassler's operation been intended to include no more than a network of great triangles, the heliotrope might perhaps have been used; as no more than two signals need have been observed from each station, and two assistants would have sufficed for their management. But the survey being necessarily conducted with a view to its immediate application to geographical and hydrographical purposes, it would have been necessary to multiply the signals to such an extent as to have rendered it impossible to employ so many separate attendants. Mr. Hassler's signals also answer well even in a cloudy state of the atmosphere, if the other circumstances be favorable, as frequently happens. The objection that two signals could rarely have shown an equally well defined image of the sun, does not hold good when a fixed instrument observing without repetition is employed. We cannot, therefore, but think that for all general purposes the signals of Mr. Hassler are preferable to the heliotrope of Gauss.

between the point of melting ice and the boiling heat of water, iron = 0.0012534363, brass = 0.0018916254,) the length of the metre was determined to be 39.381022708 inches of the scale, which, as the standard temperature of the English measure is 62 deg. Fahrenheit, gives the length of the metre in English inches:

$$= \frac{39.381022708}{1.0003152709} = 39.36861 \text{ inches English.}$$

The two copies of metres give less, (0.001 inch,) but these were compared both with the scale of Troughton in America, and that which this artist himself uses in London, and had upon both very nearly the same length; whence it may be concluded that both English scales agreed very nearly. Thus, according to Mr. Hassler's comparison, the metre is 39.36861 English inches; according to the comparison of two other copies by Kater, = 39 37079. According to Vol. III. of *Base du Système Métrique*, page 369, the metre of platinum was = 39.382755, that of iron = 39.382649: both measured upon the brass scale of Mr. Pictet reduced to the temperature of melting ice, at a mean = 39.3827; which, according to Borda's expansion for brass, (0.001783,) by which the experiments made in Paris were reduced to the point of melting ice, from a temperature = 12.75 deg. centigrade, at which they were made, gives 39.37100. The two last comparisons agree very nearly, and their difference lies entirely within the limits of the uncertainty of thermometrical influence. The authentic metre of Mr. Hassler appears, however, really to be shorter; though it could be brought nearer to the others by accepting other proportions for the expansion of metals.* This, however, appears not to be allowable when the results of different comparisons are to be collected: for the determination of the expansion is as important as the comparison itself: therefore each observer must remain answerable for that one which he adopts. I think it should be inquired whether two metals of the same chemical composition have the same proportion of expansion, or if a small chemical difference may not have a remarkable influence upon it: this investigation is more easy than that of the absolute expansion itself. It can be known only after a previous experiment of this kind, whether the results of the two observers must agree in the same metal, or if it is really necessary to determine the expansion of each piece of metal in particular. I fear that without this inquiry there must always remain an uncertainty in respect to the comparisons of standard measures.†

Among the various copies of the toise which Mr. Hassler compared to the English scale, that constructed by Lenoir, and compared by Messrs. Bouvard and Arrago, appears worthy of being accepted as

* The metre used by Mr. Hassler in his comparisons, and which the Chevalier Bessel suspects to have been too short, was *an original issued by the French commission*, and is therefore far more authentic than the *copies* used by Kater. We are happy, however, to be able to state that Mr. Hassler has recently been engaged at Washington in further comparisons, and will probably make his results public in a short time. They are said fully to confirm his former experiments.

† Copies of the metre have been made of platinum; but it will be obvious from these remarks of Bessel that it is by no means a fit substance for such purposes, inasmuch as it is both difficult to work, and not free from adventitious substances.

'authentic. When both measures are at the temperature of melting ice, this toise measures 76.74192710 inches of the scale of Troughton. By the normal temperature of both,

$$= 76.74192710 \frac{1.0002036843}{1.0003152709} = 76.73336 \text{ English inches.}$$

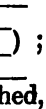
As the metre is = 443,296 lines of the toise, (*Base Métrique*, tome III. page 433,) the proportion between the English and French foot, according to Mr. Hassler, will be by the

$$\text{metre,} = \frac{39.36861}{443,296} 12 = 1.0657063,$$

$$\text{toise,} = \frac{76.73336}{72} = 1.0656411.$$

According to Kater's comparison, it is = 1.06576411.

It appears, then, that the different copies of the metre do not always agree together. Mr. Hassler deduced from several comparisons the value of the metre in parts of the toise; but this I consider as not allowable: for the ratio between the two is determined by a law, by which the metre has received its true definition; and the earlier one, that it shall be the ten millionth part of the earth's quadrant, was lost. If certain copies of these measures do not agree together, it shows only that the law is not exactly fulfilled by them; and as it is much more difficult to transfer to another metallic bar 443,296 lines of the toise than the whole length of the toise, the comparison of the metre is a circuitous and unprofitable way, as long as the toise itself is yet obtainable as easily as it was at the time of the construction of the metre.

The apparatus which Mr. Hassler had constructed for the measurement of the base line differs essentially from all that are known to me; therefore I will describe it somewhat more particularly. The ends of the bars are not planes, but cut out, so that viewed from above they present the form  ; over this middle excavation the hair of the spider's web is stretched, which therefore indicates the end of the bar; over each of the ends a compound microscope is placed, which stands upon a separate support, and therefore does not change its place when the bar is moved or taken away. When this microscope is placed over the spider's web, the place of the end of the bar is determined by it; the bar can then be taken away, and the other end of it can be made to coincide with the point where the first had been before seen to coincide with the cross strokes of the microscope, which in the meantime has retained its position independently. The microscope has the following arrangement: the object-glass consists of two half lenses of different foci, one of which makes in the focus of the eye-glass an image of the spider's web of the bar, and the other an image of two rectangular crossing black lines, drawn upon an ivory plate, which is fastened to the microscope: this arrangement can be elevated and

lowered, and moved in two horizontal directions at right angles to each other. In the use, the stand being first properly placed, the microscope is brought to that elevation in which the spider's web thread is distinctly visible; then it is moved until this thread appears exactly to cut the cross upon the ivory plate; the bar is then removed, and advanced one length forwards; the end of it is next brought into the proper position by the mechanism of the bar, and it is moved by it until the spider's web of this other end coincides again by an optical contact with the cross on the ivory plate. Of these microscopes there are three, with all their arrangements; the last ones always remain standing during the next subsequent operation, that in case of any accident the work might be begun again from them. The bar itself is a junction of four pieces, each of two metres in length, held together by iron clamps: the inclination of this bar to the horizon is measured by a sector, nearly as in Delambre's apparatus. When the work is interrupted during the night, the last position of the bar and the microscopes remain undisturbed in their position until morning. The arrangement of the boxes in which the bars are contained, and the mechanism of the movements, appear to me very well planned.

From what little I have quoted it may be easily seen that the paper of Mr. Hassler deserves the attention of those who take an interest in the mechanical arrangements necessary in practical astronomy and geodesy. It is to be lamented that such a complete apparatus as that now on hand in America has not been applied according to its intention and by its author.

F. W. BESSEL.

NAVY DEPARTMENT,
June 8th, 1830.

SIR:—In compliance with the request contained in your letter of the 26th ultimo, I enclose you the paper entitled "Principal Dates of the Survey of the Coast," which had been loaned to the former Secretary of the Navy, Mr. Southard. I have taken the liberty to retain a copy.

I am respectfully, Sir, your obedient servant,
JOHN BRANCH.

F. R. HASSLER, Esq., New York.

Translation of a Letter of Admiral Krusenstern, from St. Petersburgh, March 6th, 1831.

I present to you a little late my thanks for your kind letter that I have received by Lieutenant Antoless. Absence, sickness, and official business, have hitherto prevented my answering your letter.

I remember very well that I made your acquaintance in 1814 and '15 at old Mr. Troughton's, and frequently I have tried to obtain information if your intended Survey of the Coast of America, for which you had the instruments made in London, had not come to execution: unfortunately, this is not the case, though the navigators need very much an accurate Survey of the Coast of America.

It appears that the American Government has often good intentions, but they shipwreck not unfrequently by the different views of a new President.

As it happened with your Survey, so it happened also with the voyage of discovery; it was ready to sail, and abandoned, as I am informed from America, because the present President did not approve of the undertaking. By the papers I understood, however, that the expedition sailed at last, but shipwrecked—that is, morally. I was informed that two chiefs had been appointed—the one for the nautical part, the other for the scientific. "Two cooks spoil the soup" is an old but very true proverb, which was also verified in this. Two chiefs make chaos, against which the theory also opposes; in the praxis, such an arrangement is entirely to be rejected.

After I had become acquainted with your book upon the Coast Survey, by the Astronomical Journal of Schuhmacher, I am now, by your kindness, in possession of the book itself, which indeed contains excellent things. I have sent it to my son, an officer of the imperial navy, who has already made a voyage round the world with Captain Leïtke. My son works now, under the order of Captain Wringels, (a scholar of our famous Struve,) at a new survey of the coast of the Baltic Sea: he will study your book with great advantage to himself and his work. I regret exceedingly that your talents and extensive knowledge in this branch have not been taken advantage of in America, and that therefore the sciences and yourself lost all the benefit. In Russia your talents would have been better estimated. Such men as Admiral Greig, the astronomers Struve and Knorre, Captain Wrangel, we all would have been happy to take advantage of your services.

I have read with much pleasure the various elementary works that you have been so good as to send to me: it is a great pity that they are so little known with us; notwithstanding the great number of such works in Europe, it could not fail that also, upon these works of yours, an equally advantageous judgment would be given as Mr. Bessel has given of your Coast Survey. Your logarithmic tables I find extremely well appropriated, and I should like to see them introduced here; all depends upon it that the price be not too high; therefore, I pray you to mention to me soon what would be the price of the copy, if a number of 500 or 1000 were taken.

Once more I thank you for your letter, with which you have given me so much pleasure. I hope that, notwithstanding the great distance, you will often give me the pleasure to write to me. If I can be of any service to you here, be assured that it will give me great pleasure.

Accept the assurance of my attachment, with which, &c.

KRUSENSTERN.

REMARKS OF MR. WARD, OF NEW YORK,

In the House of Representatives, on the 29th instant, on the Bill for carrying into effect the Act providing for the Survey of the Coast of the United States.

Mr. WARD, of New York, said he did not rise to oppose the bill under consideration, but for the purpose of submitting to the consideration of the Committee on Naval Affairs the expediency of proposing an amendment to the bill, and which, if adopted, would be a means of saving much money to the nation. The Survey of the Coast, he said, was first contemplated in the year 1807, as appears by letters from Mr. Gallatin, then Secretary of the Treasury, to Mr. Hassler, and was intended for the benefit of our navigating and commercial interests. The law of that year is now proposed to be revived by the present bill, which provides that the President of the United States shall have the power to appoint a suitable person, as astronomer, to conduct it, together with officers of the army and navy. That part relating to an astronomer, or rather the employment of civil characters, was abolished in the year 1818.

Two methods were recommended for the Survey of the Coast, under the act of 1807, and, in his opinion, the wrong one was adopted—*i. e.* one by measuring a series of triangles all along the coast, connecting by them the principal points, and called a triangulation; the other that of ascertaining all the principal points by the use of chronometers and astronomical observations, and technically called the *chronometric mode.* The triangulation mode was adopted, and after being continued for ten years, and at an expense of upwards of $200,000, so little had been accomplished, that Congress put a stop to it, and wisely too, for it would have been an almost endless work, and would have expended for the nation several millions of dollars. Indeed, said he, it would have taken almost a century to complete it, judging from the progress that was made during the ten years that it was continued, and from the progress which other nations have made in similar works:—both the English and French began theirs in 1789—the former was not finished until 1820, and the latter is not yet completed. The triangulation of Ireland began in 1825, and by the report of the proceedings in 1831, it appears that only about one third part was finished. If the law of 1807 should be revived without limitation, it would bring this burthen again upon us.

The reasons why the bill ought not to be adopted, as it now stands, are, that a correct knowledge of our coasts may be obtained in a much shorter time, and at very moderate expense, by adopting the chronometric mode. It is well known, doubtless, to all the members of this House, that very great improvements have taken place in the making of chronometers within these twenty-five years. This mode of ascer-

taining points and places of a coast has been practised with very great accuracy in Europe by the English, French, and Russians, in all their late surveys; the accuracy in combination with astronomical observations is not surpassed by any other mode in ascertaining the position of places. It has been employed to correct the triangulations, and successfully, having detected an error of five seconds in time of longitude in all the stationary points in the triangulation of England.

The Coast Survey, said Mr. Ward, will not be completed, if the method of triangulation is again adopted, under sixty years, and that too at an expense of many millions of dollars, and our navigating interest will derive no earthly benefit from it whatever during all that time. Whereas, if the chronometrical method should be adopted, (and he hoped the committee would propose an amendment to the bill to that effect, when it shall have been reported to the House,) it may be completed in five years, and the results will be of use immediately to the commercial and shipping interests of our country. There are already several accurate surveys of the coast; and all that is now required is, to examine the harbors and different inlets, as also all the principal light-houses, capes, and headlands.

To the Editor of the Globe.

SIR:—Mr. Ward, in speaking in Congress, the 29th May last, on the bill "for carrying into effect the act providing for the Survey of the Coast of the United States," introduced my name in his statement of what had been done under the act of 1807, with such statements as, with all the respect for the full liberty of speech of the members of Congress, oblige me to use my liberty of a freeman, to correct statements that would be injurious to my character with people unacquainted with the facts, as provable by documents.

Mr. Ward says, in substance, as far as relates to me, that two plans were proposed for the work, the one by triangulation, and the other "a chronometric survey;" the first of which was wrongfully chosen by the late President Jefferson, continued for ten years at the expense of $200,000, by which so little had been accomplished, that in 1818 it was very properly abolished.

The facts are:—I proposed but one plan, namely, mathematical, of which all the methods that would be required, and best adapted to the localities and cases, should be applied in their proper place; going, of course, into some details, in which the triangulation, which is under any circumstance the most essential, occupied its proper rank.

Chronometric surveys were then as little in existence as now, or as they ever can be; though chronometers will in all cases be used, as the most conveniently transportable measure of time, which is an indispensable element in all such works.

The whole amount of money laid out under the act of 1807, according to the detailed amounts, passed and deposited in the Treasury Department, is $55,634 $\frac{2}{100}$.

Of this amount was spent for instruments procured from Europe, that have been used in that and other works, and most of which are still on hand, $37,549 $\frac{98}{100}$.

For the other necessary permanent parts of the establishment, and the preservation of the stations, and other incident, in setting the work to rest again, in 1818, was spent about $4000.

Some of the objects produced by this were again sold, and others, I suppose, may be still on hand.

The work of the Survey, in compensation of all employed, and all the incidental expenses, amounted, therefore, to about $13,000.

All the rest of the money, appropriated at different times, returned also at different times to the surplus funds; among these an unexpended balance of $50,000, which had been paid over to the War Department in 1818, with the view that the work should be continued by that Department, under the limitation act then passed.

The contract passed for the work, between the Treasury Department and myself, is dated 3d August, 1816.

The necessary reconnoitering, and other preliminary steps and works, occupied the time up to the 7th May, 1817, when I went into the field for actual survey operations, until 15th December, 1817, and during my calculations of that winter; the whole was interrupted the 14th April, 1818.

The ten years stated dwindle, therefore, into seven months and eight days actual field work, and the whole duration of my agency in the actual work, to about eleven months, exclusive of the time necessarily employed in procuring the instruments, and making all the necessary preparations for a work of such extent as the coast of the United States shows.

The work of the triangulation itself occupied, of this time, from 15th July to 15th December—five months, bad weather included.

What was done in that time is shown by the journals and other documents in the topographical bureau, and the account which I rendered of my plans and methods, in the Philosophical Transactions of Philadelphia, vol. II., new series, (which, I am sorry to say, is full of the most serious misprints).

For the fifteen years elapsed since, notwithstanding all that has been spoken upon that subject, certainly not as much can be shown for far more money spent with similar intentions.

The other parts of Mr. Ward's statements are foreign to the subject. I abstain, also, from all particulars and details, and refer to the documents, the book quoted, and a more detailed statement, which a similar misstatement occasioned me to publish in January, 1827, after which I thought future misstatements impossible.

The errors of the statements relating to European surveys stand corrected long ago by the documents published upon them.

I have only to add, that, upon my communicating to Mr. Ward detailed correct statements, in accordance with the above, he immediately

agreed to correct what he had said, in accordance with them, when the question would again come up in Congress; and if that occasion was delayed, a statement to that effect should appear in the papers, as is here done, with his full consent and approbation.

F. R. HASSLER.

Washington City, 18th June, 1832.

An ACT to carry into effect the Act to provide for a Survey of the Coast of the United States.

Be it enacted, &c. That for carrying into effect the act entitled "An Act to provide for Surveying the Coasts of the United States," approved on the tenth day of February, one thousand eight hundred and seven, there shall be, and hereby is, appropriated, a sum not exceeding twenty thousand dollars, to be paid out of any money in the Treasury not otherwise appropriated; and the said act is hereby revived, and shall be deemed to provide for the Survey of the Coasts of Florida, in the same manner as if the same had been named therein.

Sec. 2. *And be it further enacted*, That the President of the United States be, and he is hereby authorized, in and about the execution of the said acts, to use all maps, charts, books, instruments, and apparatus, which now, or hereafter, may belong to the United States; and employ all persons in the land and naval service of the United States, and such astronomers and other persons as he shall deem proper: *Provided*, That nothing in this act, or thereby revived, shall be construed to authorize the construction or maintenance of a permanent astronomical observatory.

Approved: July 10, 1832.

PRINCIPAL CONSIDERATIONS RELATING TO THE COAST SURVEY.

1. The act of 10th February of 1807, and the present act, equally authorize the President to cause an accurate Survey of the Coast and Shoals of the United States to be made. The additions in the second section do not alter this disposition.

2. President Jefferson never put it in any of the Secretary's offices, *ex officio*, but kept the dispositions always in his own hands, generally using Mr. Gallatin for the correspondence, (though he did also some himself,) because Mr. Gallatin understood the subject.

3. So all dispositions remained during the subsequent changes of Presidents and Secretaries, and the instruments are now yet under the

sole disposition of the President, only deposited in the topographical bureau for safe keeping.

4. It is necessary to make the President acquainted with the state and bearing of the subject as soon as possible, that he may not be committed for to the Navy Department, as this might otherwise expect to have the work in hand as matter of course, the bill being reported by the Naval Committee; but it originated in a separate motion of Mr. Verplanck, occasioned by the Presidential Message, four years ago.

5. It is absolutely necessary, for the credit of the Government and the usefulness of the work, that it be conducted in a scientific manner.

6. The general conduct of the work must be in the hands of a man of science, and under a secretary that can call to its assistance, impartially and free, all proper assistance from where it can be properly obtained.

7. The union of various means, in persons and things, is necessary to execute this work; the Navy and the Engineers will be required, each for the part appropriated to them, and civil assistance for others. This will require great knowledge of connections and interests, to prevent clashings that would destroy the utility of the work and its accuracy.

8. If the conduct of the work was in the Navy, or in the War Department, either of them would alternately refuse to work under the other, if not explicitly, at least virtually, by such clashing interests, or views, and dispositions, as would make its progress and useful execution impossible.

9. The Secretary of State appears the best adapted to take the commission of the President for that work, having less detail cares than the Treasury Department.

10. A proper Survey of the Coast must embrace, not only all that relates to the navigation of the coast, but also all the data required for directing its proper defence, &c. &c. from the Cabinet in Washington.

11. This work must be the foundation of all future surveys and similar works; the points of the main triangulation must therefore also be preserved, as starting points for the future; and the mathematical account rendered of the work must arrest and state the results referring to them, to which the alteration which the coast undergoes can be attached at any future time.

12. When properly conducted, this work will furnish several more useful results besides those of the mere survey: in a scientific respect, in spreading useful knowledge—in educating young men of the navy, army, and others, to usefulness in their professions and in the knowledge of the country, so essential in their future career.

13. Details of the plan can only be discussed after the President has decided upon the main preliminary questions.

14. If the work is not introduced so as to reach honorably all these aims, it leads to discredit, and is not worth the public attention and expense.

15. So far as only naval officers, in their present state of instruction, could do it, chart-makers by trade do it already equally as

well. Proofs enough of that exist in the complete absence of any result from all the former attempts made by the navy in that line.

The original of this I delivered to the Honorable Edward Livingston, Secretary of State, together with a letter of Admiral Krusenstern, in original, the 9th July, 1832.

F. R. HASSLER.

Washington City, July, 1832.

MOST HONORED SIR:—The President having committed to your department the execution of the law of the 10th July, 1832, reviving that of 10th February, 1807, "to provide for the Survey of the Coast of the United States," I take the liberty to present to you herewith the principles and views of my plan of operation, which, in 1807, was selected from among the thirteen under the consideration of a committee of gentlemen purposely convened, by the order of the late President Jefferson, under the late Robert Patterson, Esq., Director of the United States Mint at Philadelphia. The length of time that has since elapsed appears to have obliterated the recollection of its nature and tendency, which then procured for it the preference, as capable of giving the necessary accuracy of results, and as uniting the greatest public usefulness with economy in time and expense.

The subject appearing therefore as if new, I must take the liberty to enter into details, occasioning repetitions of things that I have formerly stated; for which I hope I may be excused.

1. In all the applications of exact sciences to practical purposes, the main aim must always be to obtain *the greatest certainty of accuracy in the results;* thence also to obtain the means of proving them by the principles of the science itself: it is even necessary to aim at a much more minute accuracy than might be considered satisfactory, if that degree of accuracy shall be secured which is absolutely requisite in the ultimate results.

These principles dictate positively for the foundation of the work of an extensive survey, the necessity of a triangulation, made with all the best means that science and its auxiliary arts afford; therefore, also, there is not upon this subject a single dissenting voice among men of science in these branches. The peculiarity of the application of this ground-work according to the means and aims in a given case, directs the further use to be made of it; and, in the present state of improvement in practical mathematics, no difference of any consequence could be found in the choice of means and methods to obtain a given aim among professional men of science.

Thence came the approbation which my plans and the description of my work received from the most eminent men of science, both of Europe and of this country, when I published them in the Philosophical Transactions of Philadelphia, vol. III., New Series.

2. In the application of these principles to the Survey of the Coast of the United States, it is required to unite by the shortest route, and therefore by the largest triangles that the localities of the country may admit of, the whole extent of the coast. This will often compel the work more or less to recede from the outer line of the sea-shore; because a great part of it is a low, level, and uniform line, bordered by forests and marshes presenting no prominent objects.

The large inland bays and rivers that empty into the sea, and keep, most generally at no great distance from the actual sea-shore, for a considerable extent a course nearly parallel with it, will present the main facilities for this operation: their outlets and remarkable headlands, capes, and thence also the lighthouses, will thus be united in the most accurate and shortest manner, and receive their precise determination and relative situation.

3. This triangulation will be grounded upon an appropriate number of base lines, measured with the utmost accuracy, distributed over its whole extent in the most favorable and convenient situations. The apparatus provided for this purpose, and described in my papers on the Survey of the Coast, is peculiarly adapted to accuracy, and has been much approved as such.

4. The station-points of this main triangulation must be permanently secured for any future use, of extending the work, or applying its data to other surveys; as, for instance, to the determination of the successive changes in the soundings and channels, of the entrances of the bays and rivers, the shifting of the shoals, bars, &c., to which they all are more or less subject; insomuch that at a future period it will be found advantageous in some places to determine them anew, at regular intervals of time, of twenty or thirty years perhaps: because the history of these changes which would be thus obtained, must guide in any work that may be undertaken for the improvement of the navigation of these places; and other useful applications will certainly present themselves.

By this precautionary measure, which I took at the time of the interruption of my former work, every one of my triangle-points can now be made available in the future work.

5. To the trigonometric operations are to be joined all the astronomical determinations that are required to locate the Survey, in respect to its position upon the curved surface of the earth: these must be made with the greatest nicety, and with all the means that the science presents.

They consist chiefly in determinations of latitudes, azimuths, and longitudes, made, as often as time and circumstances will admit, upon all the principal stations; their reference to one another, by means of the trigonometric determinations, will, in addition to the mutual verification that they afford, furnish very interesting data for the figure of the earth, that are indispensable for this work itself, on account of their great influence upon our coast, in consequence of its geographical position, under a considerable angle with the meridians and the parallels for a great part of its extent.

6. It hardly needs mentioning, that a properly qualified operator

will observe such momentaneous celestial phenomena as may occur during the time of his work; these will afford data for his purpose, if his otherwise laborious task allows him to take advantage of them. The establishment of an astronomical observatory, as I had proposed in my plan of 1816, would be of great assistance in this part of the work, besides its general utility; it was therefore, in fact, *economy in time and money.*

7. At each of the principal stations, the magnetic bearings of the compass are to be observed at regular stated times of the day; for this purpose there are, in the collection for the Coast Survey, instruments, azimuth compasses, of proper construction, as described in my papers. It will be proper also to provide other apparatus for experiments upon magnetic intensity, dip, &c. &c. I had some of my own, when I was at this work before; but the press of time and circumstances did not allow me to carry on these observations with the proper regularity.

8. The many and varied observations and other works, requiring scientific knowledge and practical skill, that are included in the large triangulation, and the works connected with it, can, evidently, not be the work of a single individual; it is therefore absolutely necessary, that the chief of the work shall, besides his own work, have the assistance of able and, as much as possible, well-instructed men, having real zeal for the science itself, as well as for the object they are engaged in: these qualifications alone can command that constant assiduity, under all circumstances, which is the essential requisite for success. The results obtained by these means will present a large mass of important information, of great and special utility for the navy, the general use of the Government, and those branches of science which touch the public utility so closely as to be indispensable to any government.

9. Of this operation, a full, clear, and minute scientific account must be published, from the very observations up to the final results, with a description of the instruments, means, and methods employed in it, such as has been published of all such surveys in Europe, in East India, &c., by which such an interesting mass of documents is now on hand, that any man of science, or a government, may consult for a given purpose; amodg these it is proper that the proposed work shall take an honorable rank. Without such a public and satisfactory account, a work like the Coast Survey could never meet either confidence or approbation; therefore, it would be deprived of all usefulness, and of all credit, in the eyes of the public. We might, perhaps, even say, that, possibly, some parts of our coast may be laid down in the common sea-charts with sufficient accuracy for common seafaring purposes; but the want of any account of the manner and means by which, if ever, they were surveyed, causes the whole to be considered as not deserving of any credit.

10. But only of such a systematic trigonometric operation, with its accompanying astronomical part, is it possible to render such a satisfactory account: all determinations grounded upon accessory means, as chronometric determinations, needle surveys, and such like, do not admit of it; because they are grounded upon repeated approximations

that always leave an uncertainty, inadmissible in a concatenation of determinations, and keep every result in a floating condition, rendering the whole unsatisfactory. While, on the contrary, the accounts of triangulations that are extant, such, for instance, as of the French works, of which some are now a century old, are such, that they could be, and actually have been, calculated over again, by the newer scientific means, to a satisfactory comparison with the newest works. In fact, such descriptions, and the results of such works, never die for the sciences and for future usefulness; and such must be the aim of the Coast Survey, if it shall deserve the attention of the nation, and the expenses inseparable from it.

11. In point of economy of time and money, it must be at once obvious, that only that method can be economical in both respects, which gives directly accurate and constant unchangeable results, and the most in a given time: this is obtainable by the trigonometric operations above described, and *by no other.*

To presume upon stating a precise time within which such a work, undertaken in any way whatsoever, will be fully accomplished, is altogether preposterous, and might be considered as a proof of a want of acquaintance with the subject. The localities of the country, which have never yet been closely investigated; the peculiarities of the ground of the soundings; the more or less favorable seasons or circumstances; and the means in operators, instruments, and accessories, that may be disposable, have too great an influence, to allow one to speak upon that otherwise than for giving detail parts. The men in whose trust the work is given must, by their honesty and zeal for the work, deserve the confidence of the Government in this respect, as well as in all others: their honor and credit are too closely enlisted in the task, not to call forth all their exertions towards presenting honorable and early results: in this, and in their ability, lie the principles of all possible acceleration, as well as of the successful execution of the work.

12. Those parts of the sea-shore that do not admit of being taken up directly in the large triangulation, and which lie intermediate between any two points of the same, will be accessible, from the one or the other of them, by secondary triangles, receiving their determination and verification from the large triangulation. Thus the errors which a close following of the sea-shore, by too small triangles, might introduce, will be avoided, as well as the local difficulties which these localities present; this proceeding will relieve the operators from all anxiety upon their ultimate results, and avoid the influence of all those local difficulties upon the great main results of the work; it will therefore greatly accelerate the work, and it will be possible to execute these parts with much less expensive means.

13. Besides this interpolation of the less accessible outer sea-shore, the interior of the main triangulation will be filled up with similar secondary triangles, receiving their determination from the larger chain, and forming the trigonometric canvass of the detail surveys of the bays and large rivers, which must be inserted in the general work by their means.

14. These two parts will be the works of able assistants or engineers, either from the army, the navy, or civil engineers, who may present sufficient guarantee for accuracy; they shall give a proper scientific account of the part of the work committed to them, proving the accuracy of their results from the very observation up, in a similar manner as in the large triangulation; and these accounts must be deposited, for future use, with the whole mass of the works.

15. The fully minute detail topography, forming the filling up of all the preceeding operations, will be made best, and more quickly, by the plane-table, which, for this purpose, has peculiar advantages; presenting to the surveyor the land, at the same time that he makes his geometrical delineation of it; dispensing him from loading his memory or note-book with details that can never be so minute and accurate as the actual aspect; besides that, any accidental omission or mistake can be corrected immediately, which would lead into difficulties, in the habitual way of plotting from field-books. To these surveyors the triangulation is given accurately upon the papers which they have to fill up; and, for this purpose, the projection of the triangles must be peculiarly adapted; under this guidance, no error can occur without being immediately detected, before it has become of influence; thence, also, the surveyor works with great security and consequent celerity, relieved from all anxiety as to his results, because all distances are given to him.

16. Surveys with compasses and chains, as in common land-surveying, are, in no case or stage of the work, admissible, under any form whatsoever. The scale of the whole work is given by the triangulation down to the very details; only minute detail distances may occasionally be measured by the chain, where, in a line of sea-shore, off-sets are to be taken, which the detail surveyor may not be willing to delineate by estimate.

17. For the main triangulation, the principal instruments are still on hand, from the collection made in time for this work; though needing some repairs, they are, however, immediately available, though, in future, an extension of the collection may become desirable and advantageous. For the secondary triangles, this collection, as formerly made, is more reduced, on account of their application to other useful works, of the Engineer Department, and otherwise.

Of the plane-table instruments I caused only two to be constructed in London, to serve as samples for the greater number required, which it was my intention to have constructed in this country as they should become necessary.

It will be proper to observe here, in passing, that the great variability of the refraction on our sea-shore precludes entirely the use of the repeating circle with two telescopes, measuring the angles in the plane of the objects; for the triangulations, an instrument of the theodolite kind, that is, measuring the horizontal angles, is alone applicable, while a repeating vertical circle is indispensable for the vertical angles, both terrestrial and celestial.

18. Thus, and by these means, the Survey must be brought to delineate the whole sea-shore, and all the principal bays, harbors, and

rivers, navigated by sea-vessels, to such limits as may be desirable. The multitude of triangle-points, and other well-determined prominent objects, along the sea-shore and in the neighborhood of it, selected also with a view to their greatest distant visibility at sea, furnish now a number of well-determined accurate base-lines for the nautical survey; upon them the determination of the points of the soundings must be grounded, and can alone be grounded with any hope for accuracy, within the limits of their visibility.

This applies, therefore, equally to the soundings along the outside sea-shore, and to those of the inlets and inside bays and rivers.

19. The method most advantageous, as well as most expeditious, for the determination of the places of soundings, within sight of some of the points determined by the survey on land, is the application of the problem of these points: it is proper that this be done always upon a double series of points, if ever possible, for mutual verification; because, the position of the vessel being temporary, any error or omission would be irrevocable; and in the case of the points falling in a circle, which cannot always be judged from the point of observation, the problem itself becomes indeterminate, and no result would be obtained: other methods, which individual localities may suggest to a well-informed observer, will but seldom occur, so that it would be useless to enter into details in respect to them.

20. The determination of the place of a vessel at the moment when any sounding is taken, requires therefore, at least, three simultaneous observations with reflecting instruments, which are the only ones applicable on board of vessels. The collection of instruments for the Coast Survey has several reflecting repeating circles, made according to my directions, so as to correct all the errors of the instrument by a double observation. Though, in this individual case, the repeating circle may not always be applicable, for want of time of stay of the vessel, their result will, however, be preferable; because, even by a single observation, they furnish correction for eccentricity, &c. Though, therefore, for this special part of the work, other good reflecting instruments will, of course, be equally used, they will serve better in all observations connected with astronomical observations, as admitting more time. A greater number of reflecting instruments will, of course, be required in the sequel of the work, and it will be proper to have them as uniform as possible, because the observations made by them will necessarily often be plotted by other persons in an office, in the absence of the observer, whose journals must therefore be kept very explicit and minute, as well as upon a general conventional form.

21. For soundings out of sight of land, where such may occur, those operations will be brought into activity that are dependent upon the joint results of chronometers and reflecting instruments, in the manner of determining the place of a vessel at sea, or the simple geographical determinations of latitude and longitude, by astronomical observations, which are too well known to need a detailed mention, except that it must be observed, that the chronometric determinations of time on board must always be compared with corresponding ones on shore, at the nearest well-determined places, and that

even without removing the chronometer from the vessel to the shore, or inversely, as the alteration they might undergo by it might easily be more than all the errors of the observations might be. For these observations out of sight of land, the repeating reflecting instruments will be particularly advantageous; the results obtained with them, by different observers and under various circumstances, have given the fullest satisfaction.

Though it might be attempted to try the determination of soundings out of sight of land, by the rate of going of vessels from well-determined points, either with steam-boats or others, there is too much uncertainty remaining, in respect to the steadiness of this rate of going, to allow the expectation of greater, or perhaps even the same, accuracy from such a method, than from the mere geographical determinations just quoted.

22. Otherwise than in the manner and in the case detailed in the preceding section, chronometers can never be used for any determination of distances in an actual survey; though they will be used as the most convenient instrument for the determinations of smaller intervals of time for the astronomical observations connected with it, on account of their transportability; by this qualification they have greatly superseded the use of the clocks that were employed before. But, notwithstanding all the improvements of later years, they, by their construction, as well as by the nature of the determinations themselves, which they are intended for, cannot enter into any line of comparison with the means that we possess from other sides, and the methods above described; their accuracy is, besides, subject to uncertain chances, to which it would be the utmost imprudence to subject the results of an extensive survey. It is seldom that a chronometer retains the same rate on board of a vessel as it has on shore; therefore, not only the transfer from one state to the other is to be avoided, as above stated, but even the well-determined rate on shore is no fully certain proof of its rate at sea. From all these circumstances, the accuracy of chronometric results is always more or less in a floating state, inadmissible in a survey, though it may be disregarded in trans-marine determinations.

This uncertainty forms, in some measure, for each chronometer, a certain determined quantity, that may equally effect small and large differences of longitude; because, the effect of any defect of a chronometer is dependent on the accidents to which it is object by it, and not on the intervening length of time. Chronometers free of defects are never obtainable with certainty; chance has still the greatest share in producing them; thence arise the high praises which chronometer-makers bestow upon themselves in their public advertisements, when, among so many hundreds of chronometers, which they make, two or three are successful; and these have been bought, as a reward, by the government of the country where they were made.

23. It may be still observed, in relation even to that use of the chronometers which has been assigned to them, that a permanent well-attended observatory would be of considerable service, in like manner as the observatory of Greenwich has served for the determination of the longitude of Madeira and Heligoland, &c. &c., made by Dr. Tiarks, under order of the British Government, which has been both the most

successful expedition of this nature ever made, and the fullest proof of the inapplicability of chronometers to actual surveys, and whereever geodetical means are possible; for, of twenty-nine chronometers, all equally well recommended and tried, and rated in observatories, in fact, about three gave satisfaction, and of the rest, a great number cannot even be said to have given a result.

24. In determining the soundings of bays, harbors, or any special part of the shore, it is necessary to have tide-waiters at both ends, and even at intermediate places, observing its stand at properly-divided parts, erected for the purpose, and at determinate small intervals of time, agreed upon and determined by the chief of the sounding embarkation, in order that the soundings made at any time on board may be referred to the state of the tide at the moment, and reduced to an uniform state of low water. The quantity of rise and fall of the tide must be ascertained, as well as the direction of its currents in rising and falling. All the peculiarities of this phenomenon must be minutely explored and recorded, as they are necessary data for the navigation. Such details, and many others relating to other parts of the work, will form the subject of the special instructions, with which it will be proper to furnish every operator in detail parts, all through the work.

25. These are the outlines of all the successive operations that will procure an honorable and permanently useful execution of the work, uniting the greatest utility and the accuracy absolutely required with all reasonable speed and economy. It must be executed by the best means and methods, obtainable from proper artists, and devised by science; the more perfect the means in assistants, instruments, and all that can facilitate the observations and other works, the greater will be the speed, the economy, and the usefulness of the results,—the more fully it will answer its aim, and become the base and standard of any future surveys that may be desired.

26. The present renewed law, by a proviso, prohibits the application of it to the establishment of a permanent astronomical observatory, no doubt, with the view to provide, in a more adequate manner, for such an establishment as the state of civilization of the country, and the wants of the navy, actually require, for utility and credit equally. When even New Holland and the Cape of Good Hope have such observatories, that have yielded permanently useful results; and Russia, a country that rose out of complete darkness, at the same epoch when our country received the first impression of civilized footsteps, has about twenty well-endowed public observatories,—we can no longer delay such an establishment. The amount paid annually by the navy, for ascertaining the rates of chronometers, to watch-makers ill provided for accurate determinations, and which ought to be done in such an observatory, would provide a considerable part of its maintenance; and some of the most essential instruments needed are still in the collection made for the Survey of the Coast. The absence of the assistance of such an establishment, for the Coast Survey, must necessarily be supplied, in the mean time, by temporary arrangements, such as I had already begun preliminary to my former operations.

27. Of the mechanical organization of the work it will not be neces-

sary to speak much in detail. It is necessary that the general direction be under a man of proper scientific acquirements in that branch of applied mathematics, in the same manner as all the great works of this nature have been in Europe: all originated first and were directed by members of academies of sciences or philosophical societies. For the assistants, the secondary triangulation, and the details, men of sufficient capacity and knowledge in each kind of work must be selected and placed under the direction of the chief, to enable him to accelerate the work gradually more and more, as more elements are obtained for their employment; and the law very properly provides, that naval and military officers, and citizens, should be employed indiscriminately, according to the peculiar direction of their knowledge and their fitness to the different works. A chief to whom the work can be entrusted will know how to make the distribution and the detail organization in such a way, as to take the best advantage of this disposition of the law, and of the men in the three classes, who undoubtedly will present themselves, to tender their assistance in a work that will be considered as an occasion for useful and honorable employment of their endowments and acquirements.

28. It is, of course, necessary that the assistants be all directed to follow the directions of the chief, who will give them written instructions as to their functions, and the principles most proper to follow in their works; that they deliver all their works, journals, &c. to the chief, and to no other person; that, therefore, the work shall centre around him, until ready for delivery to the Treasury Department, without whose orders or direction, no part of it shall be communicated to any other person. The chief must, by his own work and the organization of the whole, have provided himself with proper means to verify the works of the assistants in each branch.

29. As the results of the works must present, not only the delineation of the shore, the soundings, and what may appertain to the safety of navigation, but also all that can in any way be useful for the direction of the defence of the coast, in any given case or place, it is evident, that the entire mass of the results of the work is for the Government of the country alone, and only the part useful for general naval purposes is published in the charts. Thus the works of this nature are always treated in Europe, and this very reason is alone the cause why they are not generally known.

30. As my former operations in this work were already made with all these views, and in conformity to this plan of operation—as the instruments procured by me in time for this work are calculated for such a plan, there are in general more on hand to execute the same than there would be for any other plan; my work of 1817 becomes immediately available for the purpose, and it will be possible to present, at a much earlier period and at much less expense of outfit, valuable results. The preliminaries of such works are, by their nature, always long, and very tedious; these are, in part, made by my former works, and, therefore, so much of time and expenses is directly saved; besides that, the approbation which this plan of operation has received from every competent judge and the public in general, appears to

stamp it as the only one that can be adopted with credit and success.

31. I might quote, as additional support, more particular details of the numerous works that have been executed, all invariably upon the same principles; but they may be considered as sufficiently known by the extensive public accounts of them that are printed. I consider it therefore proper to refrain from extending this letter over these particulars, as not properly appertaining to an official paper.

I have the honor to be, with perfect respect and esteem,

Most honored Sir,

Your obedient servant,

F. R. HASSLER.

Hon. LOUIS M'LANE, Sec. of the Treasury of the U. S.
Washington City.

Upon the Articles of Agreement between the Treasury Department of the United States and F. R. Hassler, relative to the Survey of the Coast of the United States.

1. Mr. Hassler engages to undertake the direction of the Survey of the Coast of the United States, according to the law to that effect of 1807, and the act to put the same in activity, passed in 1832, as well by performing such of the principal parts of the same as will require his own personal work, as by directing and superintending the work of such officers of the army and navy, and also civil engineers, as will be appointed, upon his recommendation, in the other parts and the detail surveys, the determination of soundings, and such like.

2. He will, for that purpose, have the use and disposition, for himself or his assistants, of the instruments and all other necessary implements, books, &c. that have been procured in time for that purpose, and such others as will be procured successively for the same use.

3. He will also be provided with the proper means of safe conveyance of these instruments and other objects, either by land or by water, according to the arrangements which he will make, at proper times, for that purpose.

4. He will receive the assistance of such officers, cadets, midshipmen, or other men of the military or naval service as will be appointed upon his request, and who will be provided with all their necessary field equipments, &c.

5. All the assistants and men, military, naval, or civil, that will be appointed for this service, will be ordered to conform to his instructions and directions, and in case of their refusal, he will have the liberty to order them to report for other services, or dismiss them.

6. He will have the sole and free disposition of the carriages or other means of conveyance, and other objects or implements appertaining to the equipments for this work.

7. He will be provided with tents for the instruments and for the accommodation of himself and his assistants, with the necessary tools for preparing stations, placing signals, and the other necessary works, for the encampment on the stations, and mending implements, &c. that might be in need of it, the necessary means for signals, and for the preservation of the stations of the Survey.

8. One of the assistants will act as accountant for all public expenses made upon the orders of Mr. Hassler, and will receive from the appropriations made for the Survey such sums, at different times, as shall be agreed upon. He will account for them, at stated times, to the Treasury Department, for which service he will receive a compensation.

9. All drawing, plotting, execution of maps, or such like, will be done by the assistants, upon Mr. Hassler's orders, either in their private quarters or in an office, as may be judged best adapted to the case; the office expenses will be paid by the accounting officer on public account.

10. All the stationery needed in the work, as well for Mr. Hassler as for any of the assistants, will be provided by the accounting officer, at public expense, in the field or at home.

11. Officers or engineers, detailed out by Mr. Hassler for separate works, of detail parts, or others, will conform to the instructions which they will receive from him upon their work; they will be furnished with such instruments, implements, and assistance as he will direct; and their expenses of a public nature will be accounted with the accountant above stated. They will report to Mr. Hassler as he will direct: for such works they will receive adequate compensation.

12. Mr. Hassler will receive for compensation of his services $3,000 per annum, and in lieu of his private personal expenses, $2,000 per annum; to be paid together quarterly, upon his draft, bill, or otherwise, unless, in the progress of the work, he should be obliged to make voyages at greater distances, when an allowance, by the way of milage, will be determined.

13. Mr. Hassler will be provided with an ostensible public paper, stating his employment, and the nature and object of the same, to support him in his actions and transactions in any part of the country he may have to go for the purpose of his work, to serve equally for his assistants and the persons employed under him.

F. R. HASSLER.

Washington City, August 6th, 1832.

Instruments, Implements, and Assistance required.

1. These cannot be very essentially different from what they were in 1817. In the present state of the instruments and their accessories, it will be best to give them under detailed inventory, as stated in its

place, to the disposition of the chief of the work, to take the best advantage of them that they will afford, to have them put in as good order as possible, and to allow him to replace the missing accessories the best he can.

2. The carriage made purposely for the transportation of the principal instruments was sold, but is yet on hand, and can be made serviceable until a new one may be constructed, which would most likely delay too long at present. For the other parts of the transportation it will be easy to get a Jersey wagon, as has been used before.

3. Horses and harnesses it will be necessary to purchase, the first strong and sure, the second simple but strong. The mode of transportation of the instruments by a proper carriage, made of a size exactly to serve as a box for them, and upon springs and thorough braces, has been found more secure and economical for this country than the transportation by hand. It admits therefore also to reduce the number of laboring hands for the work of the triangulation.

4. The whole party in the work must be supplied with the necessary tents for their encampment in the field, and other necessary field equipments, besides axes, pick-axes, spades, and other tools, required for the placing of signals, preparing stations, and keeping every thing in good order. (I have even always such tools with me as are proper for keeping the instruments in good order and repairing lighter accidental damages.)

5. It must be observed, that the proper provision and arrangement of the accessories, and even the ease of an observer, are essential elements of accurate observations, as well as attentive and intelligent assistants; both favor the unimpeded and proper progress of the work, and are therefore essentially economical. A defective state of these parts is very detrimental.

6. It is expected that none of the chronometers will be in a serviceable state; that defect may be supplied by the loan of a second-pendulum clock at West Point (of Troughton's arrangement), made expressly for transportation, which is not expected to be in use there;—even a circular instrument of Troughton's, which is there, most likely, in the same predicament, might be borrowed with advantage for the secondary triangles mentioned in the proper place.

7. The selection of the assistants in officers or other able men must, of course, belong to the chief of the work, who will recommend them, and they will receive their appointments from the Department, but, if necessary, removed upon the proposition of the chief of the work. For the present first beginning, to execute the part stated for the immediate work, three such persons will only be required, whom I wish to name, besides what accidental help I shall have to call my son in for, on account of his acquaintance with the former work.

8. The number of laboring men will vary at different times; when the base lines are measured, fifteen to twenty will be required for the simple triangulations, particularly that proposed at present in completion and extension of the triangulation made in 1817; six or seven may be sufficient, besides the drivers for the carriages and what may be needed for detail triangulations, if they are undertaken simultaneously.

9. The best manner of getting this part of the assistance in laboring men, is to take them from the military, where they may be easily spared from some garrison or other: their habit and regulation of discipline, and their being placed under the order of an officer, introduces much easier the necessary regularity; and they stand for their conduct under proper regulation.

10. The pay and maintenance, in every respect, of the officers and men taken from the army and navy, is in all cases to be provided for and paid by the army corps to which they belong, or the navy in general, according to the regulations in which they otherwise stand: so also they will receive all their equipments. They must in general be considered as coming to this service in the same manner as to any other in their line to which they might be ordered.

F. R. HASSLER.

Washington City, 6th August, 1832.

TREASURY DEPARTMENT.
August 9th, 1832.

SIR:—With the President's approbation you have been appointed to make, under the superintendance of this department, the Survey of the Coast of the United States, directed by the acts of the 10th of February, 1817, and 10th of July, 1832.

The act last mentioned having authorized the employment of other persons as well as those in the land and naval service, such assistants of either description as may be necessary in the work will be provided at your request.

Funds will be placed from time to time, upon your requisition, in the hands of one of your assistants, to be disbursed for such expenses of a public nature as may be properly chargeable to the appropriation for the Survey of the Coast; and he will render his accounts, approved by you, quarterly to the first Auditor.

Those expenses of the persons in the military and naval service employed in the Survey which are chargeable to military and naval appropriations, will be defrayed by the officers of the respective departments, and accounted for under the direction of those departments.

You will receive, in full for all your services, a compensation at the rate of $3,000 per annum, and for all your personal expenses an allowance at the rate of $1,500 per annum, payable quarterly, to commence on the 2d of August, 1832, you having been employed since that time in the necessary arrangements of the instruments and other preparatory works. It is to be understood, however, that you will still continue your services in the construction of weights and measures for the custom-houses as far as may be compatible with your duties in the Coast Survey, without any other compensation than what is allowed for the Coast Survey.

In all other respects than those indicated by this letter, the terms and nature of your employment will be the same as were fixed by the letter addressed to you by this department on the 3d of August, 1816.

The plan of operations and methods formerly adopted by you in the Coast Survey having been approved of, you will recommence and continue the work in conformity with them, including such modifications as are suggested in your report of the 6th instant.

I am respectfully
Your obedient servant,
LOUIS M'LANE,
Secretary of the Treasury.

F. R. HASSLER, Esq.

Washington City, 12th August, 1832.

MOST HONORED SIR:—I have the honor to acknowledge the receipt of your favor of the 9th instant, by which you are pleased, with the authorization of the President, to give into my charge and direction the important national work of the Survey of the Coast of the United States, with a compensation of $3,000 annually for my services, and an annual allowance of $1,500 for my personal expenses, to begin from the 2d instant.

I am too well aware of the great importance of the work, its exigencies and nature, and the magnitude of the task, not to appreciate duly the value of the confidence you place in me by this trust. I shall call up all my exertions to prove these feelings, by conducting the work in a manner as honorable as permanently useful to the country; for which it presents so valuable means, that I feel highly honored by the occasion thus given to me to contribute my exertions toward such an aim.

The diminution of the allowance for my personal expenses, from what they had been rated at in my first appointment in 1816, is not such that within the limits of such estimations made beforehand its effects could be distinctly foreseen; I could only say, that while I was in activity in this work in 1817, my annual expenses in my absence from home amounted to about $2,000. What effect the now somewhat changed prices of things may have in this respect, is of course impossible to foretell; therefore this is so much less an objection with me, as in any case I am certain it is not the intention of the Government to put me to pecuniary loss, and that, therefore, in case it should be found appropriate, this part may easily be modified to the exigency of unforeseen circumstances.

I shall also attend to the standarding of weights and measures, in which I have hitherto been engaged. I have taken such arrangements as will enable my assistant in it, Mr. Schmid, to prepare the works to the last stage of their adjustment which I shall then make

myself next winter, after my return from this year's field-work in the Survey. His acquaintance with the subject, and his practice in that part during his presence in all my former operations, render him fully capable to the task; and his work will abridge mine so as to bring the necessity of my personal attendance within such limits of time as will be compatible with my work in the Survey.

With thanks for the honor of your confidence, I remain, with perfect respect and esteem,

Most honored sir,

Your most obedient servant,

F. R. HASSLER.

Hon. LOUIS M'LANE, Secretary of the Treasury of the United States, Washington City.

Washington City, 19th September, 1832.

MOST HONORED SIR:—The journals of my former work in the Survey of the Coast, and the instruments, that I had requested from the collection made for that purpose, are now in my hands, and perfectly packed up. I have fully finished the correction of the proof-sheets of my Report upon Weights and Measures. I am therefore, on my part, fully ready to go into active operations, though late in the season, with the hope, under some favor of the weather, to execute yet such a part of work as, in conjunction with that of 1817, will enable me to present to Congress, before the end of next session, some satisfactory insight into the nature of it.

I take, therefore, herewith the liberty to request the necessary authorization, in any form you will find best, to call upon the proper departments for the assistants that it will be advantageous to provide me with for the present, until, next spring, the nearer and constant measures can be taken upon this part.

I take the liberty to propose, with this view, the following gentlemen, who have offered themselves, and from whose fitness for the present operations I have every reason to expect the assistance which will now be most advantageous to the work, besides that they are now not otherwise engaged, viz.: *Dr. Howard*, of Baltimore, of the Civil Engineers; *Lieutenant V. Bomford*, of Washington, late graduate of West Point; *Midshipman James L. Henderson*, of Washington. I should have liked to add the name of a private citizen also; but circumstances of the moment preclude me from it.

It will be necessary also to have seven or eight men of the army, to assist as laborers, and in the conveyance of the instruments, preparing stations, making signals, and all other incidental works that are consequent in this Survey; and that they be furnished with the necessary tents and field-equipments for their encampment on the stations, the

tools and other implements for their works, also tents for the assistants, &c. A general authorization to that effect, furnished to Dr. Howard, who, from the works he has been engaged in hitherto, is in the habit of making such requisitions, will, I suppose, be all that is needed for him to obtain all this in New York, in the neighborhood of which place my work will be; and I should furnish him with a proper list of the needful. It will be proper also to furnish Dr. Howard with funds to the amount of about $3,000, to defray the public expenses daily occurring, and provide for the restitution of such parts of the appurtenances formerly on hand for the work as are now missing, and others that will become necessary. In this part some expenses have already been incurred, of which the bills will then be handed to him. I take also the liberty to suggest the propriety of fixing for the accounting officer in general a certain allowance, such as you will find adequate to his responsibility and unavoidable small losses in such disbursements.

Upon the special functions of each of the assistants I shall, on their meeting me, give them proper written instructions, as I have done heretofore.

You will oblige me by the earliest possible decision upon the proposed choice of assistants, as also in relation to the funds, and by your communication to that effect. If any delay should occur, I will leave here directions where they may meet me in New York; as the fast advancing season commands also my celerity, in going myself to the actual scene of my work. I have the honor to be, &c.

F. R. HASSLER.

Hon. LOUIS M'LANE, Sec. of the Treasury, Washington City.

TREASURY DEPARTMENT,
September 25th, 1832.

SIR:—In answer to your request of the 9th instant, that funds might be placed in the hands of one of your assistants, to provide for the expenses which will necessarily be incurred in the Coast Survey, I have to inform you that no advances can be made to any public officer or agent for disbursement without the consent of the President; and, owing to his absence from the seat of government, that cannot now be had. On the President's return, which is expected about the middle of next month, application will be made to him for the necessary authority. In the meantime, payment will be made at the Treasury, on settlements in the usual way, for any articles purchased or any expenses incurred for the Coast Survey. I am repectfully

Your obedient servant,

ASBURY DICKINS,
Acting Secretary of the Treasury.

F. R. HASSLER, Esq., Washington.

New York, October 21st, 1832.

MOST HONORED SIR:—Your friendly favor of the 16th instant reached me only at night, on my return from some of the numerous errands which I have daily to make when I am here, to activate the mechanical part of my work. I passed next morning at Park-Place, to have the pleasure to see you; but you had left, early in the morning, for Washington. On going the day after to West Point, to see after some instruments, I was introduced to Governor Lewis, who spoke to me in relation to his grandson, Robert Livingston, who had left your letter at my house; I had therefore occasion to inform him of the situation of things relating to my assistants. On my return, I met also Mr. Robert Livingston at my house: after stating to him again what I had said to his grandfather, I advised him to apply during the winter to trigonometry and such parts of astronomy as are of direct use in the work of the Survey, to be the better prepared when in spring the regular arrangements for the assistants in this work will be made.

For the present, my assistants are one (not passed) midshipman and a late graduate from West Point, both good-willing, and therefore useful for the parts intended for them, but unprepared for assistance in the actual observations, for which I had expected the assistance of Dr. Howard, of Baltimore, who was very desirous to join me; but work being on hand for him, in his capacity of civil engineer, the decision was delayed until the arrival of the Secretary of War, whose consent was expected. On his arrival, however, he ordered Dr. Howard immediately to the Monongahela. By this circumstance, not only my own part of work is much impeded, but also my project of giving into his hands the detail triangulation of the part of my work executed in 1817 becomes impossible; and thereby the epoch at which the activity of the navy in this work, which appears so much desired, is postponed for one season farther than I had expected, because only the execution of such a work this fall could make it possible to activate them in the next season.

I have of course tried other means of getting this assistance, but hitherto without effect. I am in daily expectation of an answer upon some demands in this respect, and shall write more in detail upon this, as well as upon other parts of the arrangements that are all in arrear, to the Secretary of the Treasury. That I had thought proper to delay, until I had replaced all those signals of my former work which were to be used in my present: this is now done; and I had for it the assistance of my son, who had been with me in the work before, and therefore had the knowledge of the localities required for this part of my work; and his assistance was gratuitous, as at present I am not authorized yet to employ any assistants to whom a pay would have to be given; and even the mileage usual in active service was refused to the young midshipman accompanying me, which had been allowed before to the officer accompanying me.

I shall not be remiss in my personal exertions in any part; but this

state of things deprives me of much of their effect: as for instance, I had relied upon Dr. Howard, who is much in the habit of making reconnaissances, for this part of my work, and the consequent signalizing, on both sides of Long Island Sound, where our plan was, that he would take one side of it, while I would take the other,—therefore working double, &c. &c.

I have procured under favorable circumstances the necessary means of conveyance, and sent out a trusty and intelligent man to purchase the necessary horses, as the horse-hire during the remainder of this season would already cost more than the horses will cost.

By my personal credit in Philadelphia and here, I have indeed supplied the want of advance of funds for the public expenditures which it had been habitual to make in my former work; because it cannot be expected that so large advances as are required could be made by me. This will not hinder however that, on tendering my accounts in the beginning of next month, I shall be obliged to repeat my request for such an advance, in addition to the payment of the past, which will only supply the extinguishment of these debts.

Besides that, the breaking up of my house here, and the necessary arrangements relating to my family, will require for my private expenses even more than I shall have; and, as the discounts cannot be placed upon account to Government, the operations of that nature have too ruinous a tendency for me.

You will easily conceive also that the precautious economy to which I am naturally compelled (as my credit, as well as my daring in adventure, and the means to bear it, must be a limited quantity) is no advantage to the advancement of the work, therefore not economical.

I shall also have to repeat my request for the assistance in soldiers and field equipments, which has not yet been authorized, and which will be necessary as soon as my reconnoitering tour on both sides of the sound, for which I am now preparing to start, will be finished.

The kind interest which you have taken in this work will, I hope, plead for me in excuse for thus stating details to you upon the present state of the work and its prospects; at the same time, you will be better able to judge, and make such arrangements as will tend to placing, next spring, your grand-nephew among the assistants in the work, upon which I may have the pleasure to speak more with you after my return to Washington, next December.

Renewing to you my thanks for your interest in my behalf in this work, I have the honor to be, with best wishes and perfect esteem,

Most honored Sir,

Your obedient servant,

F. R. HASSLER.

Hon. EDWARD LIVINGSTON, Secretary of State of the U. States.
Washington City.

New York, October 24th, 1832.

MOST HONORED SIR:—Having by friends in Philadelphia procured the means necessary for the expenses of the work of the Coast Survey, I was enabled, immediately on my arrival here, to begin my operations, by placing signals again, which my son had here ready for the purpose, upon those stations of my former works which I stand in need of, to continue it further as my plan of operation requires.

In addition to my two assistants, Midshipman Henderson and Lieutenant Bomford, I availed myself of the assistance of my son, who, having been present at my work in 1817, was acquainted with the localities, and therefore of peculiar assistance. I have procured the carriage and Jersey wagon, necessary for the safe conveyance of the instruments and their appendages. Not finding the horses in this neighborhood of proper quality at such a price as I thought would be agreeable, I have sent the man whom I have engaged to take charge of this part of the assistance to a part of the country where they are cheaper and good, to make the necessary purchase.

I have also put in activity the making of the instrument-tents, and other necessary preparations; and Mr. Patten will soon have finished the transforming of the lower part of the repeating circle, that was broken, into a theodolite, according to the plan which I gave him for it, which will produce a very useful instrument for secondary triangles, in replacement of those missing from the former collection for that purpose. The weather was most generally not favorable to my operations; however, I am now ready for the reconnoitering necessary to extend the triangulation over the Long Island Sound, &c., which is the most favorable and advantageous extension of the work in its present state.

I had the expectation that Dr. William Howard, of Baltimore, who desired much to join me in my work, would be detailed for this service on the return of the Secretary of War; but he has been sent to the Monongahela, and I am thereby deprived of an assistant able to second actual observations, as this cannot be expected from my present assistants, who serve well in that part of the work for which I had requested them, but cannot yet be acquainted with observations. I had relied upon Dr. Howard, to carry on, by combined operations, the reconnoitering of the two sides of the Long Island Sound: for the above-stated extension of the work, our plan was to act simultaneously and jointly, on both sides of it. After he would have staid some time with me, I intended to direct him to make the detailed triangulation of the part of my large triangulation of 1817. By these means I had expected to make it possible that the naval operations, which must necessarily be grounded upon those works, could begin next season.

I take the liberty to suggest in this respect that Lieutenant Mackay, of the Topographical Bureau, may be detailed, for this fall at least, to join my work, as I have good reason to suppose that he would soon be able to render the necessary service in a satisfactory manner.

I expected that ere this the order from the Quarter-Master Depart-

ment, for the manual assistance of soldiers, and the furnishing of articles of field equipment, would have been received by Lieutenant Bomford; but he has not yet received any thing: this, however, will be indispensable for the further progress of the work; already in my late operations it would have been an advantage to have two laboring men at disposition.

If Lieutenant Mackay should be directed to join me, he would be the officer to whom the order for the men and the equipments would be directed; and therefore he would bring it with him, if he was to join me immediately, as it is very desirable.

I have been at West Point, to see the clock and circular instrument belonging to the Land Office, which I was authorized to receive, if not in use. Finding the clock now in use with a transit instrument, I considered the usefulness of which it would be to the Military Academy a sufficient reason not to request it; the circular instrument I found such as not to be immediately useful for me, and I therefore also concluded not to take it away at present; it may perhaps be useful in time, for the laying out of the directions of base lines, which just now cannot be undertaken. Colonel Thayer told me, on presenting the letter of request, that these instruments having now been since many years upon the list of those present at the Military Academy, it would require an order of the Secretary of War to authorize him for the delivery.

You will oblige me very much by making the request for the assistance stated here above as soon as possible, and by informing me of the result, for my direction. I have the honor to be, with perfect respect and esteem, most honored Sir,

Your obedient servant,
F. R. HASSLER.

Hon. LOUIS M'LANE, Secretary of the Treasury of the U. States,
Washington City.

New York, January 7th, 1833.

MOST HONORED SIR:—Allow me the liberty which I take herewith to communicate to you a copy of the plan of operation for the Coast Survey, which I have handed in to the Treasury Department, upon request, (some time ago,) as it appeared necessary to present again in detail the principles, nature, and tendency of the work, more than I had thought at first, under the supposition of the recollection of my earlier papers and past events.

As you may easily suppose, it was desirable for me to have the opinion of Mr. Nicollet upon it, he being an impartial man, of experience in this branch, and just near; he has perused it, and in addition to his approbation, I find, in some pamphlets which he communicated to me relating to the plan proposed in time for the map of France, the

confirmation of my assertion, "that there is not a dissenting opinion upon the principles that I proposed among the men of science in this branch," by the speech of Mr. Laplace upon that subject in the Senate, where he said, "that to make such a work there is but one way of proceeding," upon which he goes into a description of the methods, the same as you will find in my present paper, even in the details. I have caused a copy to be made of that pamphlet, which will be delivered to you as soon as done.

The arrangements for the assistance which I needed to proceed in my works having been somewhat delayed, I began of course with the smaller means I had, which gradually increased, as to young officers, to all that I could make use of. But as the necessary field equipments, for my assistance, officers and men, were never authorized to be received, by which the going out with the larger instruments was made impossible, and became unadvisable to attempt at a later season, I found it best to proceed further in placing signals, and laying out the work for the next campaign; and indeed the time would then not have been sufficient to bring the instruments in proper order for use, an operation which is to be done upon the first station in the field.

I returned here on Christmas eve, expecting to find an authorization of the Treasury Department, or the Topographical Bureau, to receive in Boston the instruments from the Coast Survey collection that have been lent to the Governor of Massachusetts, as had been promised to me long ago. As they will be needed for next summer, and may need repairs, &c. before, it is proper that they be procured now, not to be obliged to lose a more precious time for this object next spring. I have repeated my demands to that effect, and am ever since in daily expectation of this authorization, without which it is not proper for me to go to Boston, to expose myself to a refusal on account of the want of it.

I have in the meantime directed the repairs of the instruments that I have now in hand, and intend coming to Washington as soon as I have done the same in relation to those which I hope to get in Boston.

After my arrival at Washington I shall bring into proper order the particular plans, formed in my late excursions, for the triangulation to be executed fully next summer, and its connection with my work of 1817, which I shall then also have the pleasure to present to your inspection.

I have taken the liberty to intrude upon you with this letter, not with a view to call forth any active interference on your part, but because I consider it on my part a duty as well as a satisfaction to keep you informed of the state of this work, which owes to your exertions the benefit of being brought again into a proper and, I hope, honorable channel, towards which I consider myself bound to all exertions in my power.

I have, some years ago, requested from our legation in London the procuring of some weights from Mr. Troughton, and last summer directed Dr. Tiarks also to procure some books, desirable for the collec-

tion of the Coast Survey, to deliver to the legation. The Treasury Department has added to both the authorization to pay all expenses on the account of the Department. The first have never yet been received, but are said to be ready; the second are promised by a letter received yesterday. It would be very desirable that you would please to mention occasionally to the legation, that acceleration of both is much wished for.

If upon the call for foreign weights and measures, which you was so good as to direct last year, some should have arrived, I shall be glad to make the comparison of them this winter.

I have as yet only a part of the copies of my Report upon Weights and Measures, so that I have not been able to give it all the course abroad that I wish. It might lead to informations, if copies of it were communicated by the legations abroad, as the same subject has of late been treated by most European governments, as Austria, Russia, Prussia, Denmark, Holland, &c., besides England and France, from where we have the public accounts. The return communications of the proceedings of other operators in this line would be of great interest for me.

Please to excuse this long letter, and accept with my best wishes my perfect respect and esteem.

Most honored Sir, your obedient servant,

F. R. HASSLER.

Hon. EDWARD LIVINGSTON, Sec. of State of the U. S.
Washington City.

DEPARTMENT OF STATE,
Washington, Jan. 12th, 1833.

SIR:—I have received your letter of the 7th instant, and will at the first opportunity transmit to the Chargé d'Affaires of the United States at London an extract of that part of it which relates to the purchase of weights, and call his attention to the subject. I now transmit herewith an extract of a dispatch from Mr. Vail respecting the books requested of Dr. Tiarks, with copy of a letter from the brother of the latter gentleman. It gives me great pleasure to be informed of the progress making in the interesting work in which you are zealously engaged, and to assure you that every facility in my power will be afforded you for the fulfilment of that object.

I am, very respectfully, your obedient servant,

EDWARD LIVINGSTON.

F. R. HASSLER, Esq., New York.

MR. TIARKS TO MR. VAIL.

48 *Fenchurch Street, Nov. 9th*, 1832.

SIR :—I take the liberty to state, that, after having forwarded Mr. Hassler's letter from Washington to my brother, Dr. Tiarks, who has been residing this summer on the Rhine and last at Heidelberg, I have received his reply by yesterday's post, with an inclosure from Mr. Hassler, which I have forwarded by way of Liverpool

As you were kind enough to send the letter, I beg to state that Dr. Tiarks has written to the booksellers at Hanover for the works which Mr. Hassler will require from thence, and that he has sent a list of books which he considered essential, to be bought in London, independent of those which Mr. Hassler specifies. The books from Germany are to be addressed to Mr. John Hunæman, of Queen Street, Soho, who is a literary agent for almost all the Germans who have such kind of business in London, and an exceedingly honest man, and who will therefore, by the time he receives the German books, have collected here and be ready to forward the whole to Washington. I shall take the liberty of stating to you when every thing is complete.

Dr. Tiarks felt very much pleased to find Mr. Hassler again in active service in an undertaking for which he is so very capable, and which has been the hobby of the best part of his life.

I have the honor to be, Sir,
Your very obedient servant,
H. F. TIARKS.

Extract of a Despatch from Mr. Vail, Chargé d'Affaires of the United States at London, of the 14th November, 1832.

On the receipt of your despatch No. 6, I called on Dr. Tiarks, for the purpose of delivering to him the letter inclosed in it from Mr. Hassler, requesting the Doctor to purchase certain books wanted for the Survey of the Coast. Finding that Dr. Tiarks was in Germany, I left the letter with his brother. The communication of this gentleman, of which I inclose a copy, will apprize you and the Secretary of the Treasury, to whom I beg that it may be submitted, of the progress which has been made in the execution of his commission.

Montpelier, February 22d, 1832.

DEAR SIR:—I have received your favor with the accompanying copies of your Report on Weights and Measures. I have forwarded the two—one for Professor Patterson, and one for the University of Virginia—and shall dispose of the others as you desire. For the copy allotted to myself I return you my thanks. The decrepit state of my health, added to my great age, and other causes, have prevented me from looking much into the work. My confidence in your aptitude for it takes the place of a positive proof of its merits.

I am glad to learn that you are to resume the important labor of Surveying the Coast. I hope you will be able to complete it, and to your own satisfaction, in which case I doubt not it will be to the satisfaction of those who invite you to the undertaking.

I tender you, Sir, my esteem and friendly salutation.

JAMES MADISON.

Mr. HASSLER.

Washington City, February 27th, 1833.

MOST HONORED SIR:—This morning I wished to speak to the Secretary of War upon the subject of the assistants for the Coast Survey to be ordered from his Department, he answered that he would speak with the Secretary of the Treasury upon it, as he was going there.

This evening I am informed that he proposed to establish a Committee of the Under-Secretary of the Treasury, a gentleman from the War Department, and one from the Navy Department, to direct this *business.*

You know that it is the question of *work* which requires certain determined scientific acquirements, and a Committee can do no *work* in this *business,* but impedes all work; now that I was preparing for my early going out, all would come under deliberation, with conflicting interests, and the work of course would be lost.

I will not enter into details or personalities, which I know too well, but wish to disregard. I take only the liberty to state to you the fact, with the wish that you would please to prevent the *starting even* of such a project, because it would undoubtedly bring the work to that shame from which your kind exertions have retrieved it some months ago.

I am sorry that the subject lies so close to me and what I suppose would be considered my private interests, though in an economical respect it is by no means so; I would otherwise have quoted the reasons on the side which interests me more—namely, the true

interest and honor of the country. All that I can say here, therefore, reduces itself in its ultimate: that under any Committee whatever, established as above, the work being impossible, I would be obliged to withdraw instantly, and leave the whole to its unhappy fate, from which I had tried to rescue it, and for which your kind exertions had so well laid the foundation, and concurred with me to make it honorable and useful to the country.

This circumstance gives me to lament that the work itself was not put in your Department, as I had first proposed; though for the ease in respect to the necessary money arrangements, which, by the nature of the work, fits better in the Treasury Department, the arrangement in itself is good, and its former placement in it was an induction for placing it again in that Department. That the proposed Committee would bring it in the line which it is absolutely necessary, for the honor and interest of the country, not to let it fall, is certainly evident to you, and I hope will excuse me with you if I pray you would please to bestow some exertions upon letting the arrangements taken subsist as they are now.

The President having given this law in commission to you and to the Secretary of the Treasury equally, I am, I hope, excused in addressing myself to you, even in form of regular business. The case requires immediate action; because, if a resolution is once taken, ever so erroneous, it is tried to be supported, and any delay will deprive us directly of the work of this year and its expected result, at which I was until this evening laboriously engaged. I hope therefore also to be excused with you for this intrusion, and recommend myself to the continuance of your kindness, and the work itself to your protection.

I have the honor to be with particular esteem,

Most honored Sir, your obedient servant,

F. R. HASSLER.

Hon. EDWARD LIVINGSTON, Secretary of State,
Washington City.

Washington City, March 25th, 1833.

MOST HONORED SIR:—Immediately after my return here from my work of last fall for the Survey of the Coast, I planned a full report upon my past work, an exposition of the plans for the work of this year, with a statement of the assistance which I stand in need of for their execution.

This paper being ready, I considered it proper on my part to speak with the Secretary of War in relation to the officers which my report required, in order that I might present to you at the same time his consent and co-operation in the plan.

Speaking to the honorable Secretary on the 27th February, upon that

subject, and naming to him the officers required, he answered that he would speak with you that same morning.

In the evening of the day I was informed that plans of another nature than those adopted by you, according to my propositions and plan of operation for that work, were in contemplation, which would be utterly destructive to the work itself and its useful and honorable execution. This communication being only verbal, I found it more proper to make also my remarks principally verbally, and to press a decision in proper time, that I might not, by such propositions as would occasion a discussion leading into a loss of time, be deprived of the time which the work itself requires so imperiously; for if I should meet with a delay of only two weeks in the spring, its consequence might be a postponement of the results which I contemplate to present next winter for one whole year; because, if the work cannot, during one season, be brought to a certain result furnishing the proper elements of calculation for the ensuing winter, these calculations are of course postponed for one whole year, because the summer must be constantly employed in the field operations.

Such a delay implies therefore also the postponement of the secondary triangulation, the detail works, and the naval survey for one whole year, while, on another hand, it is very much desired that these should begin as soon as possible.

In this uncertain state of things, my report, intended to be delivered about a month ago, was supplied temporarily by a mere statement of the assistance now required for my further work, which has been left at your office, and I wish it to be presented to you with the present; your answer upon it having been referred to last Saturday, and being expected to meet with full approbation.

Now the season opens, I have executed the preparatory works till to the packing of the instruments; I have furnished the plan of the instrument which is to supply those that are to be given off to the state of Massachusetts, and otherwise, and those that have formerly been broken by accidents; and nothing remains for me to go to the field-work, except the determination upon the assistants.

I intend leaving here this day week for New York, to finish the preparations to go into the field, and am therefore forced to take the liberty to request an immediate decision upon the question of the assistants that I am to be furnished with, according to the agreement upon that subject of August 9th, 1832.

Before leaving, I wish, by your decision, to be enabled to leave here the directions to my assistants when and where they shall meet me, that no further delay may occur.

For the case of any of the officers required by my note here joined should not be able to join me in proper time, I take the liberty to request that you will please to authorize me to select and appoint from among the many gentlemen who have offered to me their assistance in the work, such as it will be most advantageous to appoint temporarily, under such emoluments and conditions as I shall be able to agree upon with them, and will in time communicate to you for approbation.

I must add that the decision is urgent, and that therefore you will extremely oblige me by such an immediate decision as will save to this important work the loss of this year's work. I have, &c.

F. R. HASSLER.

To the Hon. Mr. LOUIS M'LANE,
Secretary of the Treasury of the U. States.

Washington City, March 30th, 1833.

MOST HONORED SIR:—To complete the assistance required at present for the Survey of the Coast in the part requiring civil appointments, I take the liberty to request that you will please to authorize me to enter into negotiation with the following gentlemen in their different capacities, viz.:

Mr. James Ferguson, of Albany, who has been assistant in the Survey of the North Western part of the Boundary Line with Canada, under Major Delafield, as first civil assistant.

Mr. Charles Loss, of New York, who has been assistant of Dr. Tiarks in the determination of the parallel of 45°, east of Lake Champlain, as second assistant.

Mr. Robert Livingston, of New York, who has directed his studies particularly with a view of application to such work, as third assistant.

You will oblige me also to state what compensation you will authorize me to offer or agree upon with them. As soon as I shall know their answers, I shall take the liberty to present the whole to your approbation.

As the rank and file of the army have been considered as not advantageous to be used for the manual assistance of the work, I take the liberty also to request that you will authorize me to engage proper men, under monthly pay, of good conduct, and such as confidence may be placed in for faithful and attentive attendance. The number required will at first be eight; and when either parties are sent off for secondary triangles, or the base-line is to be measured, there will be need of a proportional increase of them, according to the circumstances of the work.

I have, &c.

F. R. HASSLER.

Hon. LOUIS M'LANE, Secretary of the Treasury,
Washington City.

Washington City, March 30th, 1833.

MOST HONORED SIR:—There is needed for the Survey of the Coast an instrument of superior quality for the mixed astronomical and geodetical operations that require peculiar care, and, with inferior instruments, consume a great deal of time, which is saved, and therefore the work so much shortened, at the same time as its quality is much increased, by superior instruments, particularly of the kind and qualification of that which I have made a full plan of, in its proper size, for the direction of the artist in its construction.

This is so much more needed, as the observatory which it was intended to build, by my former plans, is now not allowed to be of a permanent kind, and one of the instruments intended for this kind of observations has been broken by a hail-storm on the Northern Boundary Line, and the others are rather in less good condition than would be desirable.

It is intended to give off several of the instruments from the collection made formerly for the Coast Survey to the state of Massachusetts and to the War Department, for the determination of some boundaries; the amount of which will be refunded to the Treasury Department, for the Coast Survey appropriation, and which will fully and most likely over pay the expense incurred for the above instrument, which will be much more useful to the work in every respect. I take the liberty to request that you will authorize me to order this instrument of Mr. Troughton in London, who, having made most of the instruments that I formerly procured, under my directions, is the most able to understand now my directions and the aim of the instrument.

In the progress of the Coast Survey, an increase of the number of instruments is unavoidable, and to procure them always from abroad long and expensive. We possess now in this country workmen whom I could very well guide in the construction of them; as it was my intention at all times, in procuring of the inferior instruments only in small numbers, to serve as samples for the rest.

But for all divided instruments, better dividing engines would be needed than the artists of this country have and could well afford to procure under the present circumstances. I wish therefore very much you would authorize me also to order a dividing engine of six feet, of the same artists, or of Thomas Jones, in London, which would enable us to have the instruments as well executed in this country as abroad, with much less loss of time, and more appropriated to our individual uses. It is evident that the instruments daily needed for the navy, and otherwise, could then also be procured in this country under the same advantages.

The expense incurred for such an engine would soon be repaid by these advantages, and is not of a sufficient great amount to be considered in comparison with these advantages; and I should recommend to press its construction as much as possible, after the execution of the above instrument. It is evident that both these objects united are a

very great economy for the intended work of the Coast Survey, by the great economy of time which they will procure. Instruments made in this country can be superintended and their execution pressed: in procuring them from abroad, we can only await for the will or convenience of the artist, and ultimately must abide by what he sends us, whether fully appropriated to our aim or not. To these circumstances it was due, that at the first outfit of the work, my mission to Europe for instruments was unavoidable, and it was even difficult for me to obtain all so entirely appropriated to our peculiar aim. I would hardly have more labor now to direct workmen here, in this line, than I had at the time to direct the artists in England. I consider it besides a valuable object to free our country in this respect from the dependence from abroad.

I have the honor, &c.

F. R. HASSLER.

Hon. LOUIS M'LANE, Secretary of the Treasury.

Washington City, April 1st, 1833.

MOST HONORED SIR:—The unfortunate conflagration of the Treasury Department occasions me to take the liberty to communicate to you copies of three letters handed in to you last, as, even if saved, they would most likely not be found immediately, while the decision upon their objects is very desirable before my departure, which I expected, and still expect, to be possible in about two days.

As I always have copies of any document, letter, or other paper, relating to my connections with the Department, I am able to replace any of importance, and therefore will do so gradually.

I join also here the letter relating to Mr. Clinton which you desired.

You will extremely oblige me by the decision upon the questions of my restored letters, as all the rest of the concerns of the Coast Survey can be pursued, according to my arrangements, without any delay being occasioned by the unfortunate event.

I have the honor to be, &c.

F. R. HASSLER.

Hon. LOUIS M'LANE, Secretary of the Treasury.

TREASURY DEPARTMENT,
April 12th, 1833.

SIR:—In compliance with the request contained in your letter of the 29th ultimo, application was made to the War and Navy Department, to have Captain Swift and Lieutenant Bell detailed for duty on the Coast Survey, and placed under the direction of this Department. This has been done, and those officers have been directed to report to you for duty.

Agreeable to your wishes, as expressed in the communications dated the 30th ultimo, you are authorized to negotiate with and employ the gentlemen therein mentioned, viz.: Messrs. Ferguson, Loss, and Livingston; their compensation and allowance to be the same as that of the officers of the War and Navy Department who may be employed in similar branches of the same duty.

This compensation will consist of the usual pay and emoluments of those officers, and an additional compensation of $2 per diem to Captain Swift and Lieutenant Bell, and of $1 per diem to Lieutenant Bomford and Midshipman Henderson.

The compensation to be allowed to the disbursing officer of the party will be a commission of $2\frac{1}{2}$ per cent. upon the expenditures. That duty may be assigned by you to such one of your assistants as you may deem proper.

You are also authorized to employ, as suggested, such number of men as may be necessary for the performance of the duty required; taking care to be as economical in the expenditures for that purpose as circumstances will permit, and also to procure from London the instruments necessary for the mixed astronomical and geodetical operations, and the dividing engine.

You will perceive, by the inclosed copy of a letter received from the Governor of Massachusetts, that he declines the purchase, for the state, of the theodolite and telescope, as proposed by you; it being probable, as he states, that they will be able to dispense with the use of those instruments by the time they will be required by you.

I remain, very respectfully,
Your obedient servant,
LOUIS M'LANE,
Secretary of the Treasury.

F. R. HASSLER, Esq.

Round Hill, West Greenwich, Connecticut,
July 3d, 1833.

MOST HONORED SIR:—Your favor of the 25th ultimo reached me properly, and I have herewith the honor to answer upon the various subjects of its contents.

It is rather difficult for me to state from here the per-centage that the accessory expenses of freight, insurance, commission to Messrs. Baring, Brothers, & Co. should be rated at; it could be exactly ascertained from the accounts in the Treasury Department, from vouchers principally not originating with me; except that part of it which is contained in Mr. Troughton's account for cartage, boxes, and such like, and what is in mine for the purchase of trunks for the transportation. However, such an inquiry would be more tedious for any person not acquainted with the details of my mission. I may therefore be near enough in stating, that about 20 or 25 per cent. may be esteemed to comprehend the part of accessory expenses that you wish to take into consideration, excluding the direct expenses of my mission. The disbursement of the money in London, intended to be made from the amount to be received from Captain Talcot, is principally for—1st. an azimuth and altitude instrument, of a larger size than those yet on hand from the collection, which becomes absolutely necessary for the work from the present state of the instruments that I had procured in time, and by the prohibition of a permanent observatory, placed in the law; and, 2d. for the procuring of a dividing engine, which will enable me to direct the construction of the secondary instruments, such as they will be needed for our use in this country.

The great advantages of this latter part are manifest from the following circumstances: 1. It is, I may assert, impossible to get the better kind of instruments, adapted to a certain use not so specially known to the artist, without the personal direction of the mathematician who shall make use of them. 2. The habits in London in the procuring of instruments for this country are generally bad; so that what I expect in relation to the larger instrument that I have ordered of Mr. Troughton, is grounded solely upon the friendly relations in which I stand with him, and I would not expect it from any other artist in London. 3. It will be a great improvement of this branch of industry in this country, where the mere mechanical part of instrument making begins to comes up, and the dividing part cannot yet be relied upon. 4. That it will be more proper, and therefore more economical, even to have well appropriated instruments constructed under inspection here, than to rely upon the chance of what we may get from abroad. The engine required for that aim will be abundantly paid for by the advantages that will be the consequence of procuring it.

Both these objects I stated to the Treasury Department before I left Washington, and they were both approved by the department. If any money should remain there disposable, above what the above two objects will cost, there are yet so many articles needed for the work of the Coast Survey in its further progress, that the balance will be amply used up for some one or other of them; and if it should not be enough, it will also be easy to pay the balance: but as much as I can esteem, neither the excess nor the defect can amount to much.

Midshipman Henderson having sent to me his resignation of assistant in the Coast Survey, there remains now from this side only to decide upon the allowance to be made to an assistant in the second

rank, from the civil side in general; for which I take the liberty to propose the compensation of a lieutenant in the army: by this then the allowance of Mr. Livingston is decided upon, of course. Mr. Edmund Blunt Jun., of New York, whose appointment you have lately approved of, has accepted the same, and will join the work as soon as some business of his, that is now present, will be over.

The instruments of the collection for the Coast Survey that I have now here in use, are now so far again readjusted, as to be serviceable by the methods that I have devised for the special case in which I am placed. The chronometers are, as I expected, very little to be relied upon, above the few hours of interval between the observations, for which alone I make use and have need of them: they administer the full proof of the impossibility of what was once called a *chronometric survey!*

My exertions for the acceleration of my work are extremely counteracted by the quantity of bad weather that we have had: hardly more than one third of the time since I left Washington could be advantageously employed in observations as would be required, much of the earlier time being needed for signalizing, to ascertain the visibility of the stations from each other; what was expected to need three days exceeded more than eight, and the placing of the signals, though even made sometimes in bad weather, delayed equally. That this impediment is still more felt, is evident in the actual works of survey-stations, in which I have been engaged since the latter part of May; and I am now writing when the severe rain causes a dampness under which the paper can hardly be used.

You will oblige me extremely by an early answer upon the credit that you sent to London, that I may inform Mr. Troughton of it, and accelerate the construction of the instrument, which in fact I stand now so much in need of already.

I have the honor to be, with perfect respect and esteem,

Most honored Sir,

Your obedient servant,

F. R. HASSLER.

Hon. W. J. DUANE, Secretary of the Treasury of the U. States, Washington City.

TREASURY DEPARTMENT,
July, 18*th*, 1833.

SIR:—Your several letters dated the 12th and 14th instant, together with your account of expenses incurred for the Survey of the Coast, during the quarter ending on the 30th ultimo, have been duly received. The accounts have been referred to the accounting officers for examination, &c.

The course suggested by you for remitting funds to London, to pay

for the instruments being made there for the Coast Survey, is approved.

As there does not appear to be any objection to the transfer of the accounts to Captain Swift, you are authorized to transfer to him the balance now in your hands, and any warrants that may be hereafter drawn will be issued in his favor.

On the subject of weights and measures, I can at present only say, that the importance of fulfilling without any unnecessary delay the arrangements entered into with the Treasury Department, will be urged upon the proper officers of the Ordnance Department.

I remain, very respectfully,

Your obedient servant,

W. J. DUANE,

Secretary of the Treasury.

F. R. HASSLER, Esq.

St. Petersburg, July 11*d*, 1833.

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MY DEAR SIR:—Your letter dated New York, 2d January, reached me very late: it is not above six weeks since I received it, through Baron Saken. Pressing business on service, and an absence from St. Petersburg, have prevented me to answer sooner your letter, and to return you my most obliging thanks for the copy of your Report on Weights and Measures, which you have done me the favor to send. The other six copies I have delivered to those persons to whom they were destined. One of the two copies you have left to my option I shall send to Professor Pauker, at Mittau, who has published lately a voluminous work on the same subject, that has won the *prize of Demidof*, adjudged by the Academy of Sciences. He will consider your book a valuable gift; for it is indeed the production of a master, which reputation you deservedly enjoy in Europe as well as in America. I am exceedingly rejoiced to learn by your letter that your government has appointed you at last to carry through the Trigonometric Survey of the Coast of America, unfortunately interrupted for more than fifteen years, a task for which you are so eminently fitted. It appears from your letter that we are chiefly indebted for the great undertaking, so important to navigation and hydrography, to your scientific Secretary of State. Mr. Livingston, indeed, could not have given a more convincing proof of his superior mind, than by appreciating your merit, and intrusting to you, in spite of your antagonists, that great national work. I shall be highly obliged to you, if you were to inform me now and then of its progress, that cannot but interest every navigator.

We are now doing the same thing, surveying trigonometrically the coasts of the Baltic. It is conducted by Colonel Wrangel, an officer of the navy, who has been studying for more than fifteen years under Professor Struve, and has been his assistant from the year 1821 to 1831

in the great geodetical work. You have probably received his work upon the subject, (*Beschreibung der von der Universität Dorpat veranstalteten Breitengradmessung*, 3 vols. 4to.) My third son, a lieutenant in the navy, has been three years one of Colonel Wrangel's assistants, and it is only a few months ago that he has been appointed to another service. In order to determine with the utmost exactness the longitudes of the principal points in our sea, Professor Struve and Colonel Wrangel are making now a tour round the Baltic on board of a steam-boat, having with them fifty-two chronometers; at the head of this expedition is General Shubert, the son of our late celebrated astronomer, Shubert.

With respect to the Logarithmic Tables, I shall take for my institution five hundred copies, at the offered price of nine tenths of a dollar, or rather, I shall give to the publisher a full dollar, provided they are delivered to me free of all collateral expense, having neither time nor knowledge of insurance, freight, the custom-house, &c. As soon as the copies are delivered, the money shall be paid without delay to the man who has the charge of delivering them to me. Our means will not allow me to take a thousand copies, as I intended; we must limit ourselves at first to five hundred. I request you to order, with regard to the Introduction, two hundred and forty in English, two hundred and forty in French, and twenty in German. I further request you to have the copies stitched, in order to prevent mistakes and confusion in collecting them. I hope it is possible to receive them before our navigation is stopped by the ice; this will be of importance to me. I have only one objection to make against these Tables, it is their extreme minuteness; however, young eyes may not suffer by the use of them. Farewell, my dear Sir; favor me soon, I request you, with a letter, by which you will highly oblige your obedient servant,

KRUSENSTERN.

Extract.

Schuhmacher, (Astronomical Journal, No. 239, page 385,) after having given an account of F. R. Hassler having again the Coast Survey of the United States under his direction, adds: The editor of this journal cannot omit herewith to present to the Government of the United States his thanks, in which all men who take an interest in exact sciences will join him, for having taken up again this beautiful work, that had been begun by Mr. Hassler sixteen years ago. This work could certainly not be executed better by any other man than him, who in its beginning already had shown so much talent. The freedom now given to him in the selection of his assistants, is an equally wise and, as the editor knows by his own experience of many years, *an indispensable condition of success.*

Bald Hill, Wilton, Conn., July 27th, 1833.

MOST HONORED SIR:—Your favor of the 18th instant, approving the manner in which the money for the instruments ordered of Mr. Troughton is to be forwarded to him as proposed in my former letter, reached me here a few days ago. The arrangement is in progress of execution, in consequence of your approbation. I shall also transfer the whole of the public funds for the Coast Survey to Captain Swift, and, on my quarter becoming due the second of next month, hand in to him my bill for my quarterly compensation.

The necessity of accelerating the furnishing of instruments as I have proposed and now activated, has proved itself upon this station, by an accident that came very near interrupting the whole work: viz. on the 24th instant, about half past two, P. M., a storm appearing to threaten us, I took preliminarily the telescope off from the theodolite, and secured it, in a bed, in another tent,—but could not return to the instrument itself before the strength of all of us, assistants and men, was needed, to hold the tent of the instrument and the instrument itself against the severest gale, with hail and rain. With difficulty I brought the theodolite, with the help of an assistant, out of the tent in the open hail-storm, leaving the tent, the instrument's stand, &c. &c. to be blown down the hill; but, in putting down the instrument, we were blown of from it, and my coat taking in it by the wind, occasioned that it was upset. The repeating circle, treated in the same manner, escaped all accidents and injury. The derangement of the adjustment, and other accidents to theodolite, I have been able to repair, I hope, without any further consequences. While we engaged at the instruments, all our tents except one were fully blown away, partly broken; and the three barometers that were in one of them were entirely broken, so that they have been sent to New York to repair. Not three hours before that, I had been bled, on account of the severe pain in my breast, occasioned by a fall upon a rock three days before, which had been so severe as to deprive me of speech, and made me apprehend some internal lesion. The severe drenching and exertions which the storm brought upon me, together with all the other, are perhaps the cause that I am still suffering under the effect of the fall, particularly in stooping for observations.

I have in general not been favored by the weather, even besides the gale: as I am here since the 20th; and only a few hours one evening, and a few this morning, the weather was favorable enough for observations. It appears, and is stated by the inhabitants, that in this season the Long Island Sound is generally covered with fogs, that prevent the necessary vision of the signals from the two opposite sides.

These circumstances preclude entirely from making any calculation upon the necessary time of staying upon a station; as, for instance, here six clear evenings and six clear mornings would suffice for the observations of the station, and the proportion of what the time passed

here has yielded would delay us more than I hope yet to tarry here, expecting more favorable weather.

I have the honor to be, &c.

F. R. HASSLER.

Hon. W. J. DUANE, Secretary of the Treasury.

Public Notice.

By a law of Congress of 1807, renewed in 1832, an accurate Survey of the Coast is to be made.

Already in 1816, and now again, the execution of this work has been intrusted to my charge.

The great importance and value of the proper execution of it for the navigation and the defence of the country (if needed), is self-evident to every enlightened man.

Though this might have been considered as sufficiently known by the publicity of the laws and dispositions taken for their execution, it appears necessary to state more particularly the object of my stay upon the elevations having a commanding view over the Sound, the Coast, and the adjacent country, and of the signals erected upon them. Both are absolutely necessary, immediate means and consequences of the execution of this law; they have therefore the claim to the protection and freedom from all disturbance, of any kind whatever, that every other property or operation of the Government has a right to enjoy and to expect from every citizen. It is therefore herewith requested, that all the signals (consisting generally of tin cones elevated upon poles with proper means to secure their stability) be left undisturbed in all possible respects, and that the necessary work on the stations be not disturbed by intruding or otherwise.

I shall make such agreements with the owners of the lands on which the signals stand, that any deterioration, disturbance of their perpendicularity, or otherwise injuring them, shall be prosecuted by them as trespass, by which they will become properly amenable to the law, with all the claims for damages that such disturbances would occasion to the work of the Survey; and these are very great, on account of the loss of time that they would occasion, and the daily expenses incurred by the Government for this important undertaking. I join therefore also here a copy of the paper in my hands from the Treasury Department, to show cause, and obtain protection and assistance from any magistrate or public officer to whom I might have to apply in a given case.

F. R. HASSLER.

Tashua Hill, Connecticut, September 2d, 1833.

Copy.

To all whom it may concern, Greeting:

Congress having authorized and directed a Survey to be made of the Coast of the United States, and Ferdinand R. Hassler having been appointed, with the President's approbation, to make the same, in the performance of which duty he will have occasion to pass over such lands as may be in the line of his operations, it is deemed proper by this public letter respectfully to request of the owners and occupiers of such lands, that, in consideration of the great national work in which he is engaged, he and his assistants may be freely permitted to pass over and remain on the same as long as may be necessary in the execution of the duty assigned to him, and that such assistance as they may need may be freely offered them.

Given under my hand and the Seal of the Treasury of the United States, the 9th day of August, 1832, and of Independence the fifty-seventh.

LOUIS M'LANE,
[L. S.] Secretary of the Treasury.

A true copy certified.

F. R. HASSLER.

New Haven, Connecticut, September 20th, 1833.

MOST HONORED SIR:—Since I had the honor to address you last, the weather has been rather unfavorable for my operations for the Coast Survey; besides frequent rains and fogs, the atmosphere between Connecticut and Long Island was the greatest part of the time so hazy, as to impede the visibility of any signals, and even the island itself.

In a few days I shall, from here, first go more to the eastward, to place the signals required to lay out the points destined for the further continuance of the Survey towards Boston, &c., as far as they are in immediate connection with the Mount Carmel station, as they will be the last that I shall make this season upon the northern side of Long-Island Sound.

From thence I shall send Mr. Ferguson, with an assistant, westerly, to continue and further to extend the secondary triangulation, of which I have laid the elements from my main triangulation, hitherto made sufficiently to guide all minute details. I shall then, with the main party, pass from the same station directly over to Long Island, to complete the measurements of the triangles upon the main stations there, until again to the junction with my work of 1817, in the same manner as I have started from it, by the northern triangle-points, last spring. Long Island I intend to send Mr. Blunt, as a second separate party,

to continue the secondary triangulation over Long Island, of which I have partly laid the foundation, and shall further continue to do so upon the island itself from my stations there.

Thus I hope to be enabled to present a mass of work next winter that will prove satisfactory, and show, by a practical example, the principles upon which the work is conducted, and must be conducted, if it shall lead to an honorable result. In the discovery and selection of my main points of triangulation over this part of the country, I have been more successful than the first aspect of the country appears to promise, or any person somewhat acquainted with the country expected; for I found, in general, all the inhabitants unacquainted entirely with distant localities or the appearances presented from the different eminences.

I have also been able, by the special methods that I devised for that purpose, to obtain results of adequate accuracy, more so than might have been expected from the state of the instruments and the general means employed; I have no hesitation to say that also from this side the work will present itself honorably. If the season and my health, which at the present moment seem to combine unfavorably against me, should favor me a little better, I intend to protract this campaign until December, as I did in 1817, and close it by the station at Wesel Mountain, near Patterson, in Jersey, where I then had begun my work, in order to make the junction between the two works complete. If successful in these plans, I hope to put in activity next spring the minuter detail surveys of the shores themselves and the maratime soundings of the Long-Island Sound, the most part of the Long-Island shore and New-York Harbor, reaching from the Neversinks, in Jersey, to the neighborhood of Sag Harbor, near the east end of Long Island. This operation will then require a number of parties of assistants to be fitted out with instruments, help, and all necessary means. It will, of course, then increase considerably the expenditure, if it shall be carried on with the proper activity and means for success. It is therefore very desirable that in stating the appropriation to be made for the Coast Survey by the next session of Congress, proper regard be paid to these circumstances; so much more, as I expect already the above-stated separation of parties this fall will increase the expenses, so as to exhaust as well the appropriation of the last session of Congress as the balance that had remained from that of the former session. Another additional increase of expense will also occur next year by the measurement of one or two base-lines, which it will not be proper to delay longer. It would be of great advantage if the appropriation was not delayed until late in the session, which will be what is called a long session, in order that the different parties may be formed and sent to their respective stations as early next spring as the necessary previous calculations and projections may be finished; because the loss of the early season throws the work of the whole year so much back, that a full aim of results is never obtainable in such a case.

I inclose here also a copy of a public notice which it became necessary for me to give in the papers hereabout, to protect the signals of the Survey, and moderate the intrusion upon my stations of such peo-

ple as, without other interest than empty curiosity, and understanding nothing of the work or the aims of my operations, make themselves much more troublesome than any persons capable of taking an interest in it. The constant exposure to the unfavorable weather, and the cold nights upon the hills, the bleakest places in the country, were extremely contrary to my health: exerting myself always, notwithstanding, in my work, in expectation to overcome this effect by habit, produced ultimately a painful disease, which, on my move from the last station through here, obliged me to stop; besides, my presence at the new station, Mount Carmel, about ten miles in the rear of this place, could well be spared while a road was made to enable us to bring the instruments there, and various preliminary arrangements could be made by my assistants, according to the directions that I gave to them; and even in that they were much impeded by rains, fogs, &c.

I have the honor, &c.

F. R. HASSLER.

Hon. W. J. DUANE, Secretary of the Treasury,
Washington City.

West Hills, Long Island, December 1st, 1833.

MOST HONORED SIR:—According to the plan of my operations that I had the honor to communicate to you in my last, two of my assistants have been engaged since the middle of October last in the secondary triangulation of the Coast Survey, within my main triangulation made this summer and continued since.

To Mr. Ferguson I assigned the part north of Long-Island Sound, and to Mr. Blunt the part of Long Island itself; so that, since that time, we form three parties in active operation in the work, and they have already communicated to me some satisfactory results.

The weather was, however, always very adverse to operations requiring vision at large distances, by so frequent rains, fogs, and haze, that it was difficult for my larger work, with the most constant and close attention, to take advantage of every moment to obtain the observations required; thence my stay upon the stations was necessarily always protracted above my wish, though I ultimately obtained, in every case except one, all the results that I had need of.

I am now here at the station with which I may close my own campaign in the field for this season, notwithstanding that I had intended to make yet the station of Harrow Hill, near Hampstead, Long Island, principally to verify the data from which I started in the spring, grounded upon results taken from my earlier works of 1817 and those of this summer used conjointly.

This change of my intention is grounded upon the consideration that the season does not give sufficient hopes for good weather to compensate for the delay in other parts of the work that would be occa-

sioned by it; and among others in the works required to present to you in due time a report upon the whole of my this year's work, which, by the results hitherto obtained, I may do sufficiently satisfactory to show the principles of the work and their successful application.

The works of Messrs. Ferguson and Blunt in the secondary triangulation not requiring such distant vision, can and will continue, and their results will be communicated to me in time enough to be joined to those of my own work, the calculation of which will have to be my personal occupation during that time.

I shall be obliged to propose to you an increase of the number of my assistants, (therefore also of expenditure,) as well for the work of the winter as principally for the next season, for which it is necessary to provide beforehand; because the separation of two parties already made, and of one or two more that will be required next spring, would leave me entirely alone, and I am now already too weak for the best advantage of the work.

My work of this year closes therefore towards the east with the eastern points determined from Mount Carmel, in Connecticut, and the hills east of Smithtown, upon Long Island; while, on the southwest, connected with my former work, it reaches until south of the Rariton; and will furnish, within these limits, the elements of the detail and nautical determinations that I intend to set in activity next season.

I have lately received a letter from Troughton & Simms, in London, informing me of their being in readiness, and I suppose by this time in activity, for the construction of the principal instruments that I ordered of them upon the peculiar plan best adapted to the nature of my operations in the localities where I have to work; for it is a great drawback upon the advancement of the work, that I have to make out with the instruments I have, which, ever so good in principle and execution, *are no more in that serviceable order* that would be desirable. This was peculiarly and forcibly proved by my work, under the unfavorable circumstances of this summer's campaign. They also informed me of the reception of the draft of £600 that I sent to them, upon the different orders given to them. I am, of course, immediately answering to them, with the detailed special instructions that they require.

I am sorry however that the other parts of my request, relating to the necessary books, tables, &c., forwarded by means of the State Department and our legation in London, have not as yet been productive of any results. However, Mr. Vail having now given the execution of it to Messrs. Troughton & Simms, as they stated to me, I hope also this part of my requests will be accelerated, as they have promised.

As they have also promised to finish the larger instrument that I requested and described, early next spring, I am so much the less adverse to postponing some work for that time, that I may then be able to execute with proportionally greater celerity.

They have also promised to go immediately after at the execution of the dividing-engine that I ordered, which will enable us to have

the instruments for secondary works, &c. executed fully in this country under my personal direction.

I have the honor to be, with perfect respect and esteem,

Most honored Sir, your obedient servant,

F. R. HASSLER.

Hon. R. B. TANEY, Secretary of the Treasury,
Washington City.

Washington City, January 7th, 1834.

MOST HONORED SIR:—By my letter dated West Hills, Long Island, December 1st, 1833, I had the honor to inform you of my intention to end my own campaign of the year with that station, and also of the reasons for so doing. The bad weather that almost immediately fell in justified the measure earlier even than I had anticipated; I left the station, with my remaining assistants, on the 11th December.

To avoid useless transportation, with its consequent expenses, all our heavy baggage was stored in the house of Mr. Chichester, where we had lodged. The instruments were brought to New York, and there deposited in the Custom House, with our other similar objects left there last spring; a few days after, the wind having blown off the sheet-tin of the roof from that part of the building where they stood, they were removed, without receiving any injury, to a more interior part, where I hope they will be safe.

I arrived, however, in Washington only the 3d instant, P. M., on account of the necessary delays under weigh. In New York, besides the care of the instruments left at the Custom House, I directed Mr. Patten upon various mendings and other arrangements relating to instruments; and all the necessary arrangements were made relating to the works of Mr. Ferguson and Mr. Blunt in the execution of the secondary triangles, for which I specially detailed them, as well for the results now needed as for their further operations at the opening of the season, for which they may likely be able to begin earlier than my larger triangulation will be sufficiently favored by the season.

In Philadelphia I ordered of Mr. Stancliffe, a mathematical instrument maker, who had already worked at the Coast Survey instruments, under Mr. Troughton, a duplicate of all the tangent and clamping screw arrangements for the main instruments, which has become necessary by the wear and consequent looseness of those that have now served so long. I ordered also one more plane-table alidade, as more are needed than only the two on hand, which were originally intended as samples for more.

There I had the misfortune to have one of my trunks stolen from under the care of the Baltimore Transportation-Line, which occasions to me a loss of upwards of $300, besides the inconvenience of being

deprived of my winter equipments and of the beam compasses, and several other objects that I stand in need of for my present work. Only one of the proportional compasses of the Government was included in the loss; the rest were all my private property.

In Baltimore it was proper for me to get nearer information upon the views in the survey of a map of the state of Maryland, upon which Professor Ducatel had corresponded with me last summer; upon this I shall have the honor to present to you a separate letter.

I have not yet received my other trunks and boxes forwarded from Baltimore, on account of the steam-boat being under way taken in the ice.

In the meantime I have directed small beam compasses to be made here, and shall in a few days be active in the calculations and similar works, with the assistance of Lieutenant Bell, of the navy, the only assistant now present with me. I have also requested that the second assistant, hitherto engaged with Mr. Blunt, should join me here until he would again be needed in the field, as I wish to accelerate my report as much as possible, to return to New York to cause the wooden part of the apparatus for the measurement of the base-line to be constructed under my direction, which will detain me for some time, and, as stated in a former letter, this measurement should be the first work of next spring.

Upon various detail subjects, which it becomes necessary to discuss and decide, I shall have the honor to address you in separate letters.

I have the honor to be, &c.

F. R. HASSLER.

Hon. R. B. TANEY, Secretary of the Treasury of the U. S.

Washington City, January 8th, 1834.

MOST HONORED SIR:—From my early youth, I had always taken advantage of every opportunity in my travels to collect a very valuable library of the best scientific works of all ages in the branches to which I applied my studies; the part relating to astronomy was peculiarly valuable, on account of the scarcity of the books which it contained.

During the time that I passed in Europe to procure the instruments for the Survey of the Coast, I took every opportunity to complete this collection at my private expense, because I would not consider myself authorized by my instructions to lay out the funds for that aim, though it was to be expected that at a future period the whole would be purchased by the Government, as a valuable addition to the library for the Survey of the Coast; therefore, when that work was interrupted in 1818, I proposed to the War Department, to which I delivered every public property belonging to the work, the purchase of all my mathematical and astronomical library, and other similar objects, for the

small price (proportionally) of $4,500, which might easily have been paid out of the remaining appropriation of $54,000, and thereby the collection be preserved unimpaired.

The refusal of this purchase affecting very materially my economical situation, gradual sales, at great sacrifices, reduced the collection at last to the scarcest astronomical works alone, which I sold ultimately to the Military Academy at West Point, under the superintendence of Colonel Thayer, for about $1100, paid in six yearly payments.

The peculiar object of this collection is, therefore, not only missed, but also the books themselves are of no use whatsoever to the Military Academy, being foreign to the branches of study that are the proper object there; thence also they are very much neglected in proper care, and lost to utility. On another side, it would be extremely proper and useful to unite them again to their proper original destination,—the Coast Survey. It is, of course, proper for the different branches of the Government to act in accordance with each other to the greatest public benefit. It was by such feelings that I favored, last spring, the request of giving off some of the instruments from the Coast Survey collection to the War Department, against payment of their cost price, to accelerate the work of determining the boundary-line of Ohio, for which the instruments, not otherwise on hand in the War Department, would not have been procured within the time limited for the execution of the work. It is under the same feelings that now I take the liberty to propose to you to request the War Department to sell to the Coast Survey Fund the books that I sold in time to the Military Academy. The few of them that might be useful there, as in some measure touching collateral studies of the Academy, might remain. If you approve of my proposition, I will furnish the catalogue of the books, with their prices, that proper negotiations may be entered into.

The trials to which the chronometers that I had procured in time for the Coast Survey have been put in my last year's campaign, have proved them to be no more in favorable serviceable order, and they will have to be sent to their makers in England, to have them put in order again: it is, however, indispensable to have for my work a time-piece that deserves proper reliance.

Mr. Troughton has, many years ago, furnished to the Treasury Department, among other instruments, a pendulum clock, expressly constructed for transportation, as it was intended for the determination of boundary-lines in the interior. This clock, with a circular instrument, was in the hands of Major Mansfield, when Surveyor-General in the west, and he took them to West Point on his taking up a professorship there; since then they remained there unused until the last years, when the clock was used with a transit instrument, &c. Somewhat more than a year ago, I had from the Treasury Department the letter requesting the return of this clock and the circular instrument; but finding the clock in use, I did not wish to disturb its utility without being able to compensate it by another.

Now one of the clocks formerly destined for an observatory for the Coast Survey might be substituted for it, and thus an exchange made equally advantageous to both sides: the clock of the Coast Survey

is, in its kind, rather superior and more valuable than that of West Point; but there it could be mounted with the solidity which it requires, and would serve better; while the clock of West Point, purposely adapted for transportation, is peculiarly fitted for the use in the Coast Survey, where an observatory-clock cannot be applied to the field-work.

I take, therefore, the liberty to propose, that you would please to propose to the War Department to make the exchange here suggested. I have no doubt but the evident mutual advantage will decide the Department of War to accept it; so much the rather, as these instruments are, in fact, the property of the Land Office of the Treasury Department.

It would be very desirable that the whole of the negotiations upon the two points herewith proposed would be completed during my stay here this winter, that I might receive and deliver the objects, as soon as I leave again here for the next year's field-work, when I could do it with the least loss of time for my work, and when also the clock desired, or some other good time-piece, will be needed for the Coast Survey.

Your early answer will therefore much oblige me.

I have the honor, &c.

F. R. HASSLER.

Hon. R. B. TANEY, Secretary of the Treasury of the U. S.

Washington City, January 9th, 1834.

MOST HONORED SIR:—In the course of last summer, Professor Ducatel, of Baltimore, informed me that he and Mr. Alexander had been appointed by the legislature of Maryland to make a topographical map of that state, and inquired of me for a plan of execution of the topographical part and its junction with the Coast Survey.

Mr. Alexander visited me upon one of my stations, to witness my mode of operating.

When in 1816 I first began the Coast Survey, a similar desire was in the legislature of New Jersey, and Governor Dickerson offered co-operation by the interest he took in it; having, however, been elected a member of the Senate of the United States before I received the (too long delayed) authorization from the Treasury Department to treat upon the subject, and his successor, Governor Williamson, not entering into the same views, the whole was lost.

If you should find proper, in the present instance, to authorize such a mutual co-operation, the plan I then had would be equally applicable in this case as in the Jersey; a considerable part of the state lies equally in the necessary limits of the Coast Survey. This plan was—that I should be allowed, at the proper time in my work, to extend my main triangulation, at the expense of the Coast Survey, over the other

parts of the state equally, and that, in compensation, the detail surveys should be made at the expense of the state, (as it would have to do at all events,) and dependent on my main triangles, in the manner that I would direct, and therefore communicated for the use in the Coast Survey.

Such a proposition on the part of the state, so nearly imbedded in the work of the Coast Survey, would evidently be of considerable economy for both parties, and could be made use of advantageously for the acceleration of the works; I shall therefore be glad if you will please to communicate to me your wish and direction in respect to it.

The state of Maryland having to provide instruments for their works, I also offered, if it should meet your approbation, to cede for their work, against cost price, two nine-inch theodolites from the Coast Survey collection, which, in the present state of the work, are not needed; having been originally intended for the reconnoitering work, which is now carried on in a different manner, the amount to be received for them would be more advantageously applied for some other instrument actually needed for my work in the course of next summer.

The favor of your decision upon both these points, for my direction in respect to them, will oblige me.

I have the honor, &c.

F. R. HASSLER.

Hon. R. B. TANEY, Secretary of the Treasury of the U. S.

Washington City, January 10th, 1834.

MOST HONORED SIR:—I must take the liberty to address you upon the subject of my assistants in the Survey of the Coast in general, and with more peculiar reference to the works of the present year.

Upon the application made to the War Department to have Lieutenant Alexander Mackay detailed for that service, I understand that the application is declined, as well for him as for any further assistance from that Department, on occount of the officers being needed at their respective posts: the official answer may, ere this, have reached you; thence so many more assistants will have to be selected from the numerous applications that I have received from the civil rank.

Mr. R. Livingston, assistant in second class from the civil, having always been refused the compensation equal to a lieutenant of the army, which I had proposed, has so much the rather been obliged to give way to the invitation of his family to enter into other business, and has left me at the end of last year. His brother —— Livingston wishes to take his place; and I take the liberty to recommend that he be appointed, with a compensation equal to a lieutenant in the army and the addition of the daily allowance granted from the Coast Survey Funds.

Lieutenant Bomford, whom I had directed as second assistant to Mr. Ferguson, being unable to attend, on account of sickness, I had to

supply his place temporarily; he is still confined here in his family, and probably can be in no active service this winter.

When I directed Mr. Blunt for the secondary triangulation of Long Island, I had also to make a temporary appointment of an assistant for him, because I had not any of mine to spare. In this capacity Mr. Charles Renard has been employed now for some time to entire satisfaction, at a compensation which it will be proper to augment for the further continuance of his services in the work, if you approve of it.

Captain Swift, who is also the accounting officer, will go reconnoitering in Connecticut, from the east end of our last year's work, as early as the weather will permit; he will likely also need a secondary assistant. As he, however, will come here before that time, nearer particulars will then be determined verbally.

These circumstances occasion me to take the liberty further to propose to you the following:

1. To request of the Navy Department that for the beginning of next campaign, that is, in about March or April, the following two passed midshipmen be detailed as secondary assistants for the Coast Survey, with the emolument fixed for that station—namely, Thomas J. Page and John A. Dahlgreen. After the measurement of the base, I expect a further call upon the Navy Department; for a lieutenant and midshipman may likely become desirable, which I will mention in due time.

2. That I shall be allowed to appoint Mr. C. M. Eakin as assistant on the civil part, with an emolument intermediate between the first and second assistants, approaching about that of Mr. Blunt, or that of a lieutenant in the navy, as Mr. Bell now present with me.

3. If, in general, the Treasury Department will give liberty to propose from time to time when an assistant may be needed, such persons as always will present themselves to me, according to the stations to which I shall find them fitted, and with emoluments appropriated to their services, it might ease me in taking advantage of the circumstances that might tend to accelerate the work, and I would most likely be able to make several propositions in the course of next spring.

4. It might be allowed to me to establish and propose a gradual succession of advancement in emolument among the assistants of inferior emolument, as circumstances might render advisable, though it would undoubtedly have to be managed with great circumspection, and only sparingly.

5. With the five assistants as above stated, I shall be sufficiently provided, in addition to those yet attached to the work, until about next summer: to appoint more for the present would be a disadvantage to the work at the moment, particularly on account of their newness in the kind of operations to be performed next spring.

Your answer will oblige, in order to enable me to act in the part devolving upon me.

I have the honor, &c.

F. R. HASSLER.

Hon. R. B. TANEY, Secretary of the Treasury of the U. S.

Washington, January 12th, 1834.

MOST HONORED SIR:—When, by the letter of the Treasury Department of the 9th August, 1832, the Coast Survey superintendance and labor was again committed to my charge, it was thought proper to diminish the allowance for my personal expenditure from what it had been rated at by the contract of 1816, made for the first starting of the work. In my letter of acceptance of the 12th August, I stated that this diminution would most likely not be warranted by the state of things, as I had the experience from before, (as my expenses far exceeded the allowance then made, as then already acknowledged by the persons acquainted with such kind of works,) but that I would try first what might be the effect of the change of circumstances in this respect, so much the rather, as it was so easy to apply a proper remedy.

Now the trial of somewhat over one year has proved to me that, far from any diminution being warranted by the present state of things and my indispensable expenditures, they are a great deal more onerous to me than at the former time. Having not now, like then, private means left, I have also no means to endure the actual pecuniary loss to which the present allowance brings me, instead of affording me prospects of better support of my family for my increased exertions, which is all that they can depend upon; I must therefore, after this trial, already take the liberty to address to you the request to which I had referred in my letter of acceptance, and I doubt not you will see the evident justice of the case, and grant my request.

It might indeed be proper to make a new and more detailed contract upon my works for the Government, as well for the Coast Survey as for the weights and measures, which, by the above letter of the Treasury Department, were continued under my charge, without allowing to me any additional compensation; but in the present press of business, this would occasion useless delay, and a single additional article expressed in a letter will suffice, at least until the further progress of the work, and its extension, might suggest peculiar arrangements.

The whole of the works in which I am thus engaged are of such a nature, as not to be possible by mere office-hours attendance; they constantly require, not only the whole day, but very frequently a great part of the night in addition to it, and under exertions and exposures which nothing but free zeal for the aim can render able to endure: my assistants, or other persons in any way witness to my works, can testify to that, even only in the weights and measures works, when I had them alone.

The constant absence from home and family, during nine or ten months in the year, is extremely expensive,—as well by the living in constantly changing places, as by the consequences of my long absence from my family and from all attendance to its concerns. To execute my task faithfully, my time is entirely taken up, without my being able to attend to any thing at home, or any source of economy or emolument, and rest must be limited to its shortest duration; it can therefore not be found improper that I should also be fully compensated.

The contract which I had with the Treasury Department for the weight and measure concerns, allowed me $3,000 per annum, with all office expenses, &c., which is paid out of the expenditures relating to the custom-houses and revenue collection, to which the establishment is subservient, by the proper and necessary establishment and furnishing of the weights and measures needed in them, which now are in rather too much uncertainty.

Uniting the two works, which have by their nature various points of contact, I can attend the final adjustment of weights and measures in the course of the winter, after they have been properly prepared by an assistant during summer; so that, with proper arrangement, I can execute both charges: it will not be found improper, therefore, that from this side might come the means to complete my compensation to what will certainly, on proper investigation of all the circumstances, be found no more than proper for my labors and my responsibility. I take, therefore, the liberty to propose to you that, in alteration of the part of the letter of August, 1832, relating to the weights and measures, you will please to allow me for those works an additional compensation of $1,500 per annum, over the amount stipulated in that letter, the remaining parts being left as they are now, until circumstances should make it desirable to determine nearer particulars.

Though my experience might make it desirable that this change would extend also to the past year, still, as retro-active operations are rather inconvenient, this augmentation might begin only from the beginning of the quarter now running, and which expires with the 2d of February next; from thence forward I should present a separate bill at the end of every quarter for $375, in the same manner as before used in the weight and measure business.

The state of my economical position renders it extremely desirable for me that you would please to bestow to this my request the earliest attention.

I have the honor, &c. &c.

F. R. HASSLER.

Hon. R. B. TANEY, Secretary of the Treasury of the U. States.

TREASURY DEPARTMENT,
March 12th, 1834.

SIR:—The superintendence of the Coast Survey has, with the approbation of the President, been transferred from the Treasury to the Navy Department.

Your future communications will therefore be addressed to the Secretary of the Navy. I remain, very respectfully,

Your obedient servant,

R. B. TANEY,
Sec. of the Treasury.

F. R. HASSLER, Esq.

NAVY DEPARTMENT,
March 14th, 1834.

SIR:—I request that you will furnish this Department, early as convenient, a report of the system arranged by you for carrying on the Survey of the Coast, of the progress made in the Survey, and the probable time and funds necessary to complete it. I wish you to furnish also a statement of the expenditures on account of the Survey up to this date, and an estimate of the additional appropriation, as well as the officers and assistants, needed for the present year.

I am, very respectfully, &c.,
LEVI WOODBURY.

F. R. HASSLER, Esq., Washington, D. C.

Washington City, March 14th, 1834.

MOST HONORED SIR:—Yesterday I had the honor to receive your letter of the 12th instant, informing me of the transfer of the Coast Survey to the Navy Department. It causes me extremely to regret that I could never have the pleasure of a personal interview with you upon that subject of my works, where it would have been easy for me to inform you of its nature, and to convince you of the inapplicability of such a measure to the execution of it in such a manner as lies in the views of the Government, and the law itself, and which I have therefore considered it my duty to aim at.

The experience of all countries where an army and navy exist, has proved that in works of this nature it is impossible to make the officers of either one of the departments work under the other with that harmony and individual zeal which is an absolute *sine qua non* of the success of the work, and I might add to this my own experience in my work in this country. The moral organization of such a work has peculiar difficulties, which have in all countries decided to give their direction to some man of science, under a department unconnected with either army or navy, until to the latter minute details.

It was with this knowledge, and under that conviction, that the late Presidents Jefferson and Madison placed the Survey of the Coast under the Treasury Department, under Messrs. Gallatin, Dallas, Crawford, &c. It was also principally upon this ground determined, when the work was resumed, again to lay it in the Treasury Department, under which it had been in successful operation before; though, knowing the overwhelming mass of business in the Treasury Department, I had intimated it might be placed under the Department of State.

I regret exceedingly that I must state to you my inability to discharge that duty to the satisfaction, usefulness, and honor of the country, which it would be my duty to aim at, under the circum-

stances which that proposed transfer would occasion: though I have the best possible will and feelings towards the personal of the Navy Department, as well as towards every other department of the Government; and my decision is grounded entirely upon the thorough conviction of the strength of the principles above stated. I cannot, however, omit to state how painful it is for me to abandon for the second time a work to which circumstances have occasioned me to devote the most valuable part of my life and property, when I had brought it again in the course of most successful execution, with all the exertions possible and great additional pecuniary loss; and, at the same time, to disappoint for the second time the expectations which the well informed part of the citizens of this country, and the scientific public in general, had grounded upon the work in which I was engaged.

The works for the establishment of weights and measures, and hydrometers, with which I am also charged by the Treasury Department, remaining thus alone in my hands, I shall devote myself in future exclusively to the execution of the directions that I have received upon that subject from the Treasury Department, under the dates of the 12th June, 1830, 3d March, 1831, 18th June, 1831, 20th June, 1832, and those accompanying my reports upon weight and measure comparisons of the 27th January and 29th June, 1832, by means of the arrangements now in my hands. I pray, therefore, that you will be so good as to place me back again to the compensation fixed for that work, with the approbation of the President, by the letter of the Treasury Department, of the 30th April, 1831.

The favor of an early answer will oblige me very much.

I have the honor to be, with, &c.

F. R. HASSLER.

Hon. R. B. TANEY, Secretary of the Treasury,
Washington City.

Washington City, March 22d, 1834.

MOST HONORED SIR:—Your favor of the 14th instant reached me in due time; the cause of the delay of this answer is known to you by the communication which I had the honor to make to you in time of the letter which the transfer of the Coast Survey from the Treasury to the Navy Department had occasioned me to write, in which I stated my apprehensions of the increase of difficulties from this transfer, grounded upon my former experience.

The peculiar interest which the President has always taken in my work, and the desire to relieve the Secretary of the Treasury, whose department is overladen with business, have occasioned him, with the same friendly dispositions which he has always shown to me, to assure me of his full concurrence in preventing the difficulties and the clashings that might accrue from the concurrence of collaborators taken

from the citizens, the navy, and the army, which you know it is indispensable to unite, as well on account of the nature of the work as its general bearings, in order to make it yield that permanent utility and honor to the country which was always the aim of its establishment, by the law as well as by the executive; and for that even its interruption in 1818 has given the most striking proof, as well as it has shown the breakers that are in the route of this vessel.

As nothing personal ever influenced my conduct, I considered it proper for me to yield to the President's wishes, and to continue to join my exertions towards that aim, sure as I am, at the same time, that the nearer you and the Navy Department in general will be acquainted with the particulars, the more my views upon this work will obtain your approbation and support, as they have, even in their more minute parts, obtained that of the President, and had, before that, of the Presidents Jefferson and Madison, under whom the principal operations have been performed between 1807 and 1818.

As I am just now engaged, jointly with my assistants, in making up the report upon the work of last year, in conjunction with my earlier works of 1817, I refer all that part of your letter which relates to it to its completion; so much the rather, as I have had the satisfaction already, some time ago, to show to you the sketch of triangles that have been executed over an extensive tract of the country, to which my report must have reference; and I will here limit myself to answering the other questions contained in your letter.

Your second question relates to the probable time needed for the completion of the work. Upon this I must take the liberty to state, that, from my intimate acquaintance with the work and its incidents, I would distrust the ability or veracity of the man who would undertake to decide upon this by the statement of any positive time; as too much depends on the favorableness of the weather—the season—the localities of the country, in situation of prominent points, their being open or wooded—the nature of the soil near the sea-shore—and the state of cultivation of the country in general, &c. As, for instance: it occurred last season, that, in a fortnight, no more than seven hours, scattered over all that time, allowed to make geodetical observations; and all that would have related to astronomical observations was entirely impossible. I may therefore best answer this by the result of a conversation that I had this winter with the President, upon this same question. Having stated to him the impossibility of an appropriate answer in general terms, he limited the question to the part east of my present operations, which, after some reflection, I stated, would require about three campaigns more, after this, for triangulation; but that it was not my intention to make it so in succession; but that, after this year's campaign, my plan was to extend my work southerly, in order that, while the secondary and naval operations were going on over the space of the eastern triangulation, I would prepare for a similar extension southerly, to be able to place two separate parties in operation, and thereby to accelerate the work so much more. The President's answer was—"That is right; that will accelerate the work."

Seeing thus my plans well calculated, no doubt acquired to me the President's confidence—that I calculated my organization of the work to the best advantage, and he was satisfied—(he was equally so with the views which I presented to him upon the work and its requisites in general, in the further continuance of the conversation)—I can only add to this yet, that the certainty of the results obtained is celerity as well as economy.

The question of the funds required for the completion of the work is still more unanswerable: because this has still more chances of variation than the preceding; every one circumstance affecting the progress of the work affecting also this, and many more particulars coming into consideration in it; as it can impossibly be the aim to get a repetition of the common sea-charts, that have now not the trust of the public. The final and different detail executions of the work will have their particular expenses, presenting themselves only gradually, as also an increase of instruments of all kinds will present itself, occasioning proportional expenses, &c. Successive yearly appropriations will, I suppose, be continued to be made as hitherto, and I have reason to hope always more willingly, in proportion as the results and the great utility of the work will become more evident.

In relation to the statement of expenditures, I must observe, that from the very outset, in 1816, to this date, I have always declined having any thing to do with it: it would be utterly incompatible with the heavy task of the work itself. I have always been relieved from it by being directed to select a disbursing and accounting officer from among my assistants, whom I would find most capable and proper, whose accounts I attest, in so far as to state the expenses therein contained to have been incurred in consequence of my directions in relation to the Coast Survey: his accounts are rendered quarterly, and he receives the advances for the expenditures upon his own request. If circumstances occasion that I must make an expense for the public, I return my vouchers to him, and he reimburses me. This was even the case in 1816 and '17, when I put the work twice into activity by my own private funds. When in the fall of 1832 I again began the work with my private funds, and was refunded again, by an advance from the Treasury Department, I rendered one account myself; but when the present accounting officer, Captain W. H. Swift, took up his charge, I delivered to him as well the vouchers that I had in hand, as the remaining funds, which closed my short transactions in this respect.

It is therefore in the Treasury Department alone that the data lie collected which you might wish from that side.

Upon the appropriations I have to state, that the first year's appropriation was $20,000; as I entered the work only late in the season, (October,) I had the means, by proper arrangements, to make an economy in advance for the last year's campaign, for which the appropriation was again $20,000; the accumulation of both, and proper arrangements enabled me to continue the work ever since without interruption, for which the appropriation of one year would otherwise not have sufficed; so I was enabled, as is an absolute requisite for the

The plan how to proceed according to the system so well tried and approved, under the circumstances existing at the time of the renewal of the work in 1832, is one of the documents in the Treasury Department, restored immediately after the conflagration of the Department. In this form, I believe, they have all passed the judgment of the President.

The importance of the present moment for the acceleration of the work itself is so sensible, and my means of assistance necessarily so closely calculated to the exigences, that I must pray you will allow to me this reference to the documents, not to divert my time from its present important employ to that which the copying of them would require.

2. The names of my assistants. These are for the most part named in my last letter by the statement of their employments. I will, however, here put them in one connected list.

Captain W. H. Swift, of the Topographical Engineers. (His present occupation is distinctly stated in my last letter.)

James Ferguson, of Albany. (His present occupation is equally stated in my last letter.)

Edmund Blunt, jun., of New York. (His present occupation is also stated in my last letter.)

Lieutenant H. Bell, of the United States Navy, (is engaged here in the calculations stated in my last letter.)

Constant Eakin (is engaged here in the calculation and drawing stated in my last letter.)

Alfred Livingston, of New York, (is second assistant, employed with Mr. Ferguson.)

Charles Renard, of New York, (is second assistant, engaged with Mr. Blunt.)

John Dahlgreen and Thomas J. Page, passed midshipmen, having no knowledge as yet of the past works, their activity in actual work can only begin with the opening of the campaign on my part; therefore, they were directed to that effect, as stated in my last letter.

In relation to my desire of another assistant from the military rank, I take the liberty to join here a separate letter.

3. The compensation of the assistants. These have been fixed by the Treasury Department, at the time of their appointment, upon my proposition of the principles that must necessarily guide in it. In respect to the numerical statement of their amount, I must take the liberty to refer you to the account in the Treasury Department, as it is actually unknown to me.

4. The character of my measures taken, if adapted to the plans? and their successful execution? My plans being grounded upon invariable mathematical principles, as it is impossible otherwise, the means of execution are also mathematical, and admit of no other characters; they have at all times been discussed when it was the question to establish any part of them, and their proper adaptation to the efficiency, progress, and successful termination of the work, even its most economical arrangements have decided their adoption and the assent to them. If you will allow me, I should like to add, as I did in my last

letter upon the assistants, their destination and occupation; that in the present state of the work, no alteration whatsoever can be made in them, without the most decided detriment to the progress and efficient usefulness of the work, even under any plans or views whatsoever.

5. As a guide to the nearer particulars, and the Documents thereto referring, I take the liberty to recal to your recollection, that you have in your Department a copy of a paper of mine, entitled "Principal Dates of the Coast Survey," which has, against my wish, been omitted to be printed with my papers above stated, leading to the interruption in 1818, and I join here the copy of another one, made for the use of the Treasury Department, as guide, from the renewal of the work in 1832, to very lately.

My being confined to my room by sickness, for several days, I hope will excuse me for not being able to come to you; as in a short conversation so much ideas and information might be exchanged between us, as even a long correspondence is not well adapted to yield.

Allow me to set some value, for the support of my views in the work of the Coast Survey, upon the letter of late President Madison, addressed to me; as under his presidency the main plans and arrangements were in every respect fully discussed, and set in actual operation, in all respects with his personal approbation and concurrence; a copy of the letter is therefore herewith joined, &c. I shall have the honor to shew to you the original itself, on the first opportunity.

I have the honor, &c.

F. R. HASSLER.

Hon. LEVI WOODBURY, Secretary of the Navy of the U. S.
Washington City.

Continuation of the principal facts and dates relating to the Coast Survey, after the interruption in 1818.

For several years after the interruption, Mr. Felsh, Chaplain of the Navy, who had exerted himself all the session of Congress of 1817, '18, in procuring the law excluding me from the Coast Survey, was considered as engaged in it, though no trace of any work is to be found any where, unless the accounts of expenditures in the Navy Department be considered as such.

1819. *December 25th.* Mr. Jefferson's letter to me, inquiring about the state of the instruments I had procured, and their cost, with a view to purchase them for the Virginia University, saying, "as this object seems to be relinquished."

1820. *January 4th.* My answer to the above letter.

January I gave my papers upon the Coast Survey to the Philosophical Society of Philadelphia for publication; upon the report of a Committee, they were in March ordered to be printed.

1823, '24, '25. Various trials of the Navy Department to establish a

hydrographical corps, &c. &c. Lieut. Sherburne, of the Navy, coming to work near Mr. Felsh, occasioned the breaking up of his employment.

1825. My papers upon the Coast Survey came into the public; but being printed in my absence, they were much disfigured, by the change of the language, and often the very contrary is said of what I said.

December 3d. Letters of Messrs. Jefferson and Madison, Ex-presidents, regretting the interruption of the work, and approving of my methods and plans, &c. &c.

1826. *December 9th.* Colonel Roberdeau's paper upon the Coast Survey appeared in the National Journal.

1827. *January 8th.* My answer to Mr. Roberdeau's paper appeared in the New York American, the National Journal not having inserted it, as it had been requested.

1828. Report of the Secretary of the Navy to Congress, saying upon the Survey Concerns of the Navy, "Nor can such Surveys be made without the aid of the means contemplated by the act of 10th February 1807, to provide for the Surveying of the Coast of the United States."

March 26th. Letter of the Secretary of the Navy to me, requesting a list of the instruments needed for the Coast Survey, besides those on hand.

March 29th. My answer to the above letter.

Various circumstances occurred, and plans were proposed, in which I more or less was in correspondence, until a law was introduced into Congress to renew the law of 1807, upon the proposition of Mr. Verplanck, to refer to the Naval Committee so much of the President's Message as referred to that subject. My accidental passage through Washington occasioned me to speak with the chairman of the Naval Committees, and several other gentlemen, only in a cursory and transient manner.

1830. *June 5th.* Letter of Mr. Branch, Secretary of the Navy, forwarding to me my paper of Principal Dates of the Coast Survey, after having taken a copy of it. About that time also, instruments of different kinds were lent to the State of Massachusetts, to make a map of the State under Mr. Stevens.

1831. *December 22d.* Last date of the law proposed to renew the law of 1807, to activate the Coast Survey. About the same time it was intended to transfer the instruments to West Point.

1832. *July 10th.* Act of Congress, to carry into effect the act of 1807, to provide for the Survey of the Coast of the United States, authorizing to employ any men, adding to it the Coast of Florida.

July 26th. My plan of operation for the attainment of the aim of the preceding law.

August 9th. Date of my new appointment by the Treasury Department, with the President's approbation, stating my compensation at $3,000 per annum, and $1,500 for my personal expenses,

and leaving me the business of weights and measures, without additional compensation.

1832. *August* 12*th.* My letter of acceptance, stating the insufficiency of the allowance for expenditures; but as this part was easily mendable according to what experience would show, I would proceed to work immediately, and communicate results.

September 19*th.* My letter to the Treasury Department, requesting authorization to call upon the Departments of War and Navy for assistants, proposing the assistants, and requesting funds to be given to one of them, for the public expenditures.

September 23*d.* My letter relating to the refusal of Dr. Howard as my assistant.

September 25*th.* Refusal of funds in advance from the Treasury Department, and referring to payments when bills may be presented.

September 26*th.* Having in the course of the month received the instruments, journals, &c. from the Engineer Department, I left Washington for New York, where the work was to begin again; Messrs. Bomford and Henderson as assistants going with the instruments upon the steam-boat to Baltimore, where we met together.

October 3*d.* Arrived in New York with the instruments, found the signals, carriage for the instruments, and various other objects, that I had directed, in readiness, and took measures to procure the rest of the equipments.

October 8*th.* Began the placing of signals upon those stations of the Survey of 1817, that I intended to use.

October 24*th.* My letter to the Treasury Department, announcing I had procured funds upon my private responsibility, and thereby the objects and arrangements were ready for further reconnoitering in continuance of the work. Requesting also Lieutenant Alexander Mackay as temporary assistant in the reconnoitering, besides the two I had. Rendered account of the excursion to West Point for the clock and circular instrument, and the reasons why I left them; the clock being in use, and the circle I could dispense with.

October 31*st.* Date of the first warrant, No. 5996, sent to me for the public expenditure.

November 3*d.* Letter of the Treasury Department, announcing that Lieut. Mackay had been detailed as assistant; that soldiers and tents had not been required, for reasons stated before; and that I could procure manual help and the necessary equipments by the funds of the Survey; giving me also liberty to appoint a disbursing officer.

November 21*st.* My letter announcing the accounts to the 1st inst., and referring all the military or manual assistance part to Lieutenant Mackay.

December 6*th.* My letter to the Treasury Department upon the amount desirable for the next appropriation, with the reasons for it.

1832. *December* 19*th.* About the closing of the reconnoitering turn, the measures taken for some repairs of the instruments, and their location in the Custom House; the classing of the accounts upon the 1st of January, as desired by the Department, and upon the instruments lent to Massachusetts, from the Coast Survey collection.

1833. *January* 12*th.* Communication from the State Department upon the books and similar objects to be procured from London, as also upon some weights.

January 19*th.* Letter of Dr. Howard from the Engineer Department upon the instruments lent to Massachusetts, which they desire to keep longer, and not to purchase.

January 31*st.* I arrived again in Washington.

February 11*th.* I announced to the Treasury Department, what instruments I had received from the Land office, and their state.

February 21*st.* My letter about the instruments at Boston, and statement of their amount of cost.

February 22*d.* Letter of Mr. Madison upon the Weight and Measure Report sent to him, and expressing his satisfaction upon my resuming the Coast Survey.

February 23*d.* A report, that I had prepared upon my work of that fall, was, however, not found necessary, and remained behind.

March 25*th.* My letter to the Secretary of the Treasury upon causes of delay, and pressing upon a decision that I may go to the field work.

March 27*th.* My letter to Mr. Troughton in London, ordering instruments, upon a given plan of a new large instrument, &c. which was given to the State Department for forwarding.

March 29*th.* My letter, requesting Captain Swift to be detailed as my assistant, and Lieutenant Bell of the Navy.

March 30*th.* Upon Mr. Ferguson and Mr. Livingston as assistants, a letter of mine to the Treasury Department.

March 30*th.* My letter to the Treasury Department, requesting authorization to have a superior instrument made, and a dividing-engine procured from the amount to be obtained for the instruments ceded to Captain Talcot, for the determination of the boundary of Ohio.

March 30*th.* Letter from the Treasury Department, informing me of the instruments lent to Massachusetts remaining there, and of those that would be returned, with accompanying documents.

April 12*th.* Letter of the Treasury Department upon the granting of the assistants that I had requested, and their several compensations.

April 13*th.* I arrived again in New York, to begin the preparations for the field work.

April 18*th.* My letter to the Treasury Department, relating to the instruments ceded to Captain Talcot. I informed, also, under the same date, the Treasury Department upon the instruments received from Boston, and their bad state.

April 19*th.* My letter to the Treasury Department upon assistants,

particularly relating to Mr. Ferguson, proposing, also, Mr. Blunt as an assistant, and upon the measures that I had taken to procure the field equipments.

1833. *April 26th.* I left New York for the first turn upon Staaten Island, to replace signals, and further reconnoiterings, with all my assistants.

April 27th. The Treasury Department confirming the compensation of Mr. Ferguson, stated comparatively with Captain Swift.

May 2d. My letter to Troughton upon instruments.

May 24th. Captain Ramsey's list of instruments received from the Topographical Bureau.

June 2d. Letter of the Treasury Department, requesting a list of the prices of the instruments ceded to Captain Talcot, authorizing the appointment of Mr. Blunt as assistant, and upon the draft for the payment of the instruments in London.

June 15th. My answer upon the preceding letter, and other objects, relating to assistants, and similar.

June 15th. The Treasury Department asking about how much per cent. was to be added to the price of the instruments ceded to Captain Talcot, and referring to the letter of the 12th for the compensation of Mr. Livingston, stating it to be midshipman's pay.

July 3d. My answer to the above, and relating to the draft upon London, for the payment of the instruments ordered of Troughton.

July 8th. Authorization of the Treasury Department to purchase a draft upon London for £600.

July 12th. Closing of my accounts upon the public expenditures, and full transfer to Captain Swift; also my letter to the Treasury Department, informing of this transfer, and the reference upon Captain Swift for the future.

July 14th. My letter to the Treasury Department, closing the draft concern.

July 18th. The Treasury Department approving the transfer of the accounting concern to Captain Swift.

July 27th. Upon the transfer, also, of my compensation to the accounts of Captain Swift. And account of the hail-storm that we experienced on Bald Hill.

August 5th. My letter to the Treasury Department, announcing the purchase of the draft upon London, the compensation arrangement with Captain Swift, and asking a warrant on his account.

September 2d. My public notice for the protection of our signals, and my operations upon the stations.

September 20th. Account of my progress to the Treasury Department.

October 13th. I instructed Mr. Ferguson about the secondary triangulation in Connecticut, for which he left soon after.

October 17th. The same for Mr. Blunt, for the secondary triangulation upon Long Island.

October. I received the letter of Troughton & Sims, relating

to the instruments ordered to them, promising to follow my plan, and to try to furnish the large instrument early next spring.

1833. *November* 11*th*. My letter to the Economical Society of Bern, requesting to cede to me the three-feet theodolite of Ramsden; also a letter to Professor Trüchsel, to send the theodolite of Schenk, yet on hand, from him in Bern; to Korn in Arau, about his instruments; to Troughton & Sims, upon nearer details upon the instruments to be constructed for me. With the letter to Professor Trüchsel was a draft for the payment of the instrument of Schenk.

December 1*st*. I announced to the Treasury Department my intention to close the campaign of the year with the station of West Hills, where I was, and further particulars about the arrangements.

December 7*th*. My letter to the Treasury Department, requesting Lieutenant Mackay as assistant for the winter already.

December 10*th*. Letter to Dolland, requesting a telescope, and two microscopes, upon the peculiar arrangement that I have invented, to substitute optical images for the wires.

December 11*th*. The whole party left West Hills for New York, after having stored our heavy baggage at Mr. Chichester's, where we had lodged on West Hills.

1834. *January* 3*d*. I arrived again in Washington.

January 7*th to* 15*th*. Various letters of mine to the Treasury Department, upon particular subjects relating to the Coast Survey, handed in at once, which were never answered.

NAVY DEPARTMENT,
March 28*th*, 1834.

SIR:—Your letter of the 26th instant has been received. The "last letter" to which you refer, if it be the one addressed by you to this Department on the 22d instant, does not appear to contain the information requested in mine of the 25th; and I regret that none of your letters to the Treasury Department have yet been communicated to me, though I hope soon to receive them. The War Department has been requested to order Lieutenant Mackay, as desired.

I am, very respectfully, &c.

LEVI WOODBURY.

F. R. HASSLER, Esq., Washington.

Washington City, March 29th, 1834.

MOST HONORED SIR:—My letter of the 22d to you being written much with the view of abridging a subject leading into great length, if I had entered into all its details, contained in the information relating to the assistants, renewed in yours of the 25th, in the two articles near the end, beginning with "In relation to the assistants," &c., in a form which I see was too short for you to see all its bearings, because you had not yet in hand the detailed documents, by which I supposed you more informed already than, I see well, you could be, not having received them as yet.

I hope, however, that my list and account upon this part, as contained in my last, joined to the letter of the 22d, will be satisfactory, until, as I hope soon, I shall be able to have a conversation with you, to introduce you in any particulars that you may desire; and then a full letter appropriated to your views may be made, if you desire it, unless something or other should still be needed before.

I am much obliged to you for the application made to the War Department for Lieutenant Mackay, and hope it will be as successful as it is desirable.

I have the honor to be, &c.
F. R. HASSLER.

Hon. LEVI WOODBURY, Secretary of the Navy,
Washington City.

Washington City, April 6th, 1834.

MOST HONORED SIR:—The President having promised to me last Thursday to give directions relative to the appointment of Lieutenant Mackay as assistant to the Coast Survey, I must presume the decision of the War Department communicated to me by your letter of yesterday, was taken before these dispositions have reached there.

I have therefore, as it was my duty to do, immediately again addressed the President, and communicated to him your favor. I think it also proper to inclose here, for your knowledge, copies of both letters to the President, the first of which was in his hands in less than one hour after his verbal request for it, and his promise to give it effect.

I have the honor to be, &c. &c.
F. R. HASSLER.

Hon. LEVI WOODBURY, Secretary of the Navy,
Washington City.

NAVY DEPARTMENT,
April 8th, 1834.

SIR:—Your letter of the 6th instant, inclosing copies of communications addressed by you to the President of the United States, relative to the employment of Lieutenant Mackay in the Survey of the Coast, has been received.

In reply, allow me to assure you, that every exertion will be used by this Department to promote your labors in the Survey; and I have no doubt the War Department feels cordially disposed to do the same. But, as you have been before apprized, there are difficulties in detailing Lieutenant Mackay.

Yet Governor Cass remarks that "any officers of the army shall be ordered on this duty, whose situation will permit it, consistently with the rules and interest of the service."

You will therefore be pleased to furnish a list of other officers in the army, whose services are considered likely to be useful; and it will give me pleasure to submit the list to the War Department, for a selection of such a one as can best be spared from other duties.

I am, very respectfully, &c.
LEVI WOODBURY.

F. R. HASSLER, Esq., Washington.

Washington City, April 8th, 1834.

MOST HONORED SIR:—Your favor of this day gives me great pleasure, by the approbation which you give to my exertions in the Survey of the Coast, and the attention which you bestow upon it now under the guidance of your Department.

I have also no doubt but that the War Department, on full reflections, will equally concur in assisting, by the means at its disposition, a work in which it is, in fact, as much interested as the Navy Department; as by its very nature it will furnish means which, in cases of emergency, both will have equally to consult.

To answer the peculiar occasion of the call upon the War Department to detail Lieutenant Mackay as assistant in the Coast Survey, the detailed history of the whole transaction from its beginning, under the Treasury Department, will best clear up the whole, and the equal and regular course that guided me. I do best, therefore, to communicate it to you as follows:

In my letter to the Treasury Department, dated West Hill, December 1st, 1833, I stated—"I shall be obliged to propose to you an increase of the number of my assistants," &c.

My letter to the same Department, of the 7th December, requested

the appointment of Lieutenant Mackay as assistant, with the special reasons for this selection.

I arrived in Washington January 3d, 1834. I was informed, by a visit to the Treasury Department, that no measures had been taken upon this my request, and I prompted them to be taken.

I had also occasion, in a visit to the President of the United States, to state this my wish, in the course of the conversation. His answer was: the Secretary of War would report upon it, and he would consider it.

As I had immediate use for the services of Lieutenant Mackay, I went, on the 6th January, myself to the Secretary of War, who referred me to Major General M'Comb, who stated his disinclination to comply, in pretty positive terms.

However, the letter of the Secretary of War, of the 15th January, of which a copy is here joined, (as communicated to me by the Treasury Department,) by its closing phrase, did not leave me the least doubt but that Lieutenant Mackay would, on a second application, be, as is there said, "ordered to report to me."

At the same time occurred the riot of the Irish workmen upon the canal; and Lieutenant Mackay was ordered there, as one of the officers nearest at hand. I found it, therefore, not proper to renew my application immediately; and directed Mr. Renard to come here from New York, to replace him for this winter.

On the 24th March, Mr. Renard left here again for his former station, as second assistant to one of the secondary triangulations that was in actual operation already, as stated to you in time.

This occasioned me, of course, to renew my application for the assistance of Lieutenant Mackay, as by my letter of the 26th March to your Department; so much the rather, as he had just returned from the expedition he had been ordered to before, and was only ordered to Fort Washington, where I knew it was very easy to supply his services, as stated in my letter to the President of the United States, communicated to you. As you was so good as to state to me that you would also refer to the President upon it, I have no doubt but that his disposition to favor the work with good assistants will decide him not to deprive it of an officer capable of rendering valuable services, and to leave his acquirements useless to the country, by devoting him to the mere assistance in the command of a few soldiers, where any officer whatsoever almost can supply the place; and I should consider it almost impossible that any rule of the War Department should be contrary to the placing of any officer whomsoever to where his acquirements may be the most useful, when the Military Academy is purposely established to favor those acquirements just for such uses; though, for the special object of the assistance which I now require, no man directly from that Academy could be of any service, on account of the absolute necessity that an assistant as I now require must already possess many practical acquirements that can impossibly be given them there.

I may still be allowed to add, that it is well known in the service of the Engineer Department and the Topographical Bureau, that these corps not being sufficiently strong for the services that devolve upon

them, they have always been assisted by such officers of the other corps of the army whose acquirements render them desirable for these duties. I am sure the case exists now even as it has always been. I may, for all my considerations in favor of the work of the Coast Survey that are involved in this question, refer to the documents in your hands, while, as well the work itself as I, will however ultimately have to abide by whatever resolution may be taken.

I have the honor, &c.
F. R. HASSLER.

Hon. LEVI WOODBURY, Secretary of the U. States Navy,
Washington.

NAVY DEPARTMENT,
April 3d, 1834.

SIR:—In examining the correspondence relative to the Survey of the Coast, it has been discovered that your letter to the Treasury Department, as to the proposed co-operation of Messrs. Alexander and Ducatel in the Survey for the State of Maryland, has not been answered. As these gentlemen have since made a similar proposition to this Department, I inclose for your information a copy of my answer to them on the subject, the arrangement in which you will please to carry into effect.

I am, very respectfully, &c.
LEVI WOODBURY.

F. R. HASSLER, Esq., Washington.

Washington City, April 9th, 1834.

MOST HONORED SIR:—Upon your invitation, in the conversation that I had the honor to have with you yesterday, I take the liberty to enumerate here various subjects of former letters of mine to the Treasury Department that have not been acted upon.

1. Relative to the desire of the State of Maryland to join the survey of the map of that state with and under the guidance of the Coast Survey, my letter of the 9th January last contains all its bearings, and the principles upon which I think myself authorized to recommend it. I may only add, that it will occasion for me personally an increase of exertions, to which I am willing to submit, and an increase of my private expenditures, which I have the hope will be considered in another question as yet pending.

2. The State of Massachusetts has yet in hand some instruments

belonging to the collection for the Coast Survey. On taking up the Coast Survey again, in 1832, they were offered to be ceded to the state against proper compensation; this was however refused by the state, and it was only requested that the further loan of part of them should be granted, which was acceded to, while others were returned in a state mentioned in some of my letters.

By my letter to the Treasury Department of the 28th February, 1834, I stated, that some of them that I wished and needed were refused to me, unless a formal application was made through the Department by the intermediation of the governor of the state; and I desired, therefore, that this should be done. I can also, in this respect, not do more than renew my desire; all the details lie in my letter.

3. Instruments have been ceded to the War Department, for the use of Captain Talcot, to determine the boundary-line of Michigan. The prices were stated by the Treasury Department, and the instruments have all been delivered; but only a small part of the resulting amount has been paid: of all this you will find the details in various documents of the Treasury Department not in my hands.

It is desirable that the payment should be completed. The instruments that are to replace those ceded, such as will be still more appropriated to the Coast Survey in its present state, have been ordered, and funds advanced upon them, &c., which it was calculated should be covered by the amount to be received.

It is therefore evidently desirable that this account should be ultimately settled, and the amount joined to the unexpended appropriation.

I suppose that all the documents relating to these subjects have now been transferred to your Department from the Treasury Department: if any thing should be missing that I can supply, please to order it.

You will see the propriety that all these subjects should be brought to a final close. From the Treasury Department I never received any answer upon any of them.

I have the honor to be, &c.

F. R. HASSLER.

Hon. LEVI WOODBURY, Secretary of the Navy,
Washington City.

Washington City, April 12th, 1834.

MOST HONORED SIR:—Upon your favor of the 9th, relative to the junction of the survey of Maryland with the Coast Survey, authorizing me to make the proper arrangements to put the measure into execution, I shall make the appropriate agreements with Messrs. Ducatel and Alexander, combine means with them, and then give you proper details upon the plans agreed upon mutually.

Mr. Alexander has already received one of the nine-inch theodolites in New York, of which I had spoken in my letter to the Department: though they have last year been put into serviceable order, they have however seen hard days in their being lent out; and I think it would be proper to cede them at reduced price, to use the proceeds towards the payment of the other instruments absolutely required: they are yet fully adequate to smaller detail works, which it is intended to execute in the Coast Survey by other means.

The full cession of such instruments as may be spared from the collection for the Coast Survey, is far preferable to the lending of them in any way; as to avoid accidents is then the business of the new owner, on his own account; and experience has proved that the state in which those lent may be returned, is not in any way to be relied upon.

I have the honor, &c.

F. R. HASSLER.

Hon. LEVI WOODBURY, Secretary of the Navy,
Washington City.

NAVY DEPARTMENT,
April 14th, 1834.

SIR:—As recommended in your letter of the 12th instant, should the measure be deemed by you beneficial to the public, I approve the sale of the instruments alluded to, and authorize the proceeds of such sale to be applied to the purchase or repair of other instruments suitable for the Survey.

I am, very respectfully, &c.

LEVI WOODBURY.

F. R. HASSLER, Esq., Washington.

Washington City, May, 1834.

MOST HONORED SIR:—With the present I have the honor to deliver to you my report upon the works made for the Survey of the Coast of the United States, during the whole time of my agency in it in 1817, as well as in the last passed year, which it was necessary to unite.

I have every reason to hope, that the views in which it is drawn up will be satisfactory, and particularly appropriated to make known to Congress the proper character and aim of this important work; the

knowledge of which it is necessary to renew, on account of the long time that has elapsed since the original law, in the framing of which all the bearings of the work were discussed.

It appears to me all-important that this report, together with the maps of the triangulation accompanying it, shall go in full to Congress, with any such additions of yours as you may find advantageous to the further promotion of the work in the most advantageous manner, which I have no doubt will become evident from this report.

Any documents that you may think that it would be advantageous to add to this report, I shall be ready to communicate, as soon as possible, from the collection in my possession, of which copies have been made to restore those lost in the conflagration of the Treasury Department, but which it has not been possible, as yet, to finally collate, certify, and finish, on account of the mass of other work on hand.

I have the honor to be, &c.

F. R. HASSLER.

Hon. LEVI WOODBURY, Secretary of the Navy of the U. S.
Washington City.

Report upon the Works executed for the Survey of the Coast of the United States, upon the Law of 1832, *and their junction with the Works made in* 1817, *by and under the direction of F. R. Hassler.*

1. That great part of the work for the Survey of the Coast which has been executed since the renewed law of 1832, is grounded upon the work done in 1817, under the first original law of 1807. Therefore, in this first public report, of a more full and general character, which I have the occasion to render, it is necessary to go back to that earlier period, in order to give a proper view of the state of the work, its systematic connection, and its bearings in every respect, so much the more as the circumstances of the interruption, in 1818, precluded me from the presentation of the full report, which was just then in preparation.

2. I may be allowed to suppose the principles upon which the work is to be executed as sufficiently known; as well from the mathematical elements that must guide such a work in general, as by the plans that have been so repeatedly discussed and approved, upon all the occasions that circumstances have presented for their full consideration, and the test of the public approbation, that they have passed.

3. It is, therefore, rather my task here to show how these plans have hitherto been followed, to state the results that have been obtained, up to the present time, and to show their consequences.

4. The first distribution of a country into regular geometrical figures, that will approach its form the nearest, and under the most advantageous circumstances, to procure accuracy in the survey of it, requires the union of a detail knowledge of localities and theoretical principles, which is in general foreign to the habitual knowledge of the country, in respect to its civil connections; the operator can, therefore, be guided in it by no other but his personal inspection of the localities.

5. The general outline of the Coast of the United States presents, in the neighborhood of New York, a considerable angle between the main directions, easterly and southerly, and in some measure a basin, over which lines may be laid and determined, between the surrounding elevations fronting these two main directions, and thereby furnishing proper base-lines for the continuance of the works; though, therefore, I extended my first reconnoitering as far south as the Chesapeake Bay, I was ultimately, for the beginning of my work, arrested particularly by the decided advantages of that locality.

6. Guided by the idea, that behind the straight ridge of the Palisadoes, in New Jersey, bordering the Hudson river, above New York, a straight valley was likely to be found, that would present the necessary first element of any survey, namely, a nearly level base-line, of sufficient length to serve as ground to the triangulation, I directed my attention to, and found the confirmation in, the valley called English Neighborhood, of which I made a detailed survey in the spring of 1817, in order to give it the best location that the ground would admit of, and actually measured the distance between Vreelands and Cherry Hill, as more favorable than any locality that I had visited before, with the same views.

7. As habitual for such kind of works, under the expectation of taking the best advantage of the nearer investigation of the country, and not to make, at the very outset, expenses that might be more advantageously put upon a better line, this base was measured in a preliminary manner, with a chain of twenty links, of one metre each, constructed under my direction, by which it was found to be 9446.15 metres, corresponding to about 30999.8 feet English measure.

8. From Wesel Mountain, one of the prominent rocks of the Newark Mountains, first ridge, which formed the first elevated triangle-point, through a number of other elevated points, a system of triangles was laid over the whole basin of New York Bay and its surrounding valleys, that presented determined distances, eastwards for the further continuation of the work over Connecticut and Long Island, and southerly over New Jersey towards the Delaware, over the valley of which the nature of the country indicates the course for the main triangulation towards the south, to which the survey of the outer coast must attach itself at the two ends, the Delaware Bay and Long Branch; because the sea-shore itself is too flat, too wooded, and deprived of such prominent points as are necessary for a large triangulation.

9. These works exhausted the time of the summer and fall of 1817, until past middle December, even with the omission of the extreme

stations, which it was intended to occupy the next year, at the same time as the survey would be further extended.

10. Though in extensive surveys it is habitual to measure a verification base only at a considerable distance from the first base, I considered it, on the contrary, of importance in my case to have a verification as early as possible of the proportional accuracy of the base-line measured in English Neighborhood, which formed then, and forms as yet, the fundamental unit of the whole triangulation. Therefore, a second or verification base was measured in December, 1817, upon the south shore of Long Island, between a point near the Narrows, and another near Gravesend Beach, though not in a very favorable locality.

11. The length of this line was found 7753 metres, or 25443¼ feet English. The results of three different combinations of the triangles, carried out upon it, falling all within two tenths of a metre (or less than eight inches) of the distance measured, and within themselves, I had reason to consider myself sufficiently authorized to use my base-line of English Neighborhood as a preliminary standard for my work.

As this coincidence is greater than usual in common geographical operations, I considered myself also allowed to propose to ground upon the work thus far obtained the detail survey of New York harbor for the next summer, as I proposed in my letter to the Treasury Department of the 18th December, 1817. The great coincidence of sums of the angles of the triangles with that required by theory, came equally in support of this satisfactory result.

12. The whole of the observations collected during the summer of 1817, I had of course to submit to the necessary reductions, calculations, and clearing up of the results, during the ensuing winter.

Besides that, I made also the theoretical calculations that must be derived from the theory of the figure of the earth, and the best known results of the elementary magnitudes, to deduce from the data obtained by the triangulation the proper location of each point to its place upon the earth, and in time upon a map; from the same principles I deduced and calculated also those principles upon which the future maps were to be constructed, or, as usually called, the projection, which required so much more attention and reflected calculation, as in the case of the Coast Survey, it shall serve to carry the work out in the minutest details, and upon a large scale and great extent of country.

13. While I was engaged in these calculations, the law of 1818 put an end to my further agency in the work; only a few weeks before I would have been able to present a report upon my work, that would certainly have been satisfactory; as I stated in my letter to the Treasury Department of the 9th April, 1818, written in answer to that announcing to me the dispositions that led to the breaking up of the work. In consequence of which I delivered to the War Department all the journals, books, instruments, and other appurtenances of the Survey, together with an unexpended appropriation of upwards of $50,000.

14. It is necessary that the stations of a work of the nature of the Coast Survey, shall be preserved for future times and uses, in any

other surveys to which the determinations made by it will serve as fundamental units. Therefore I had caused hollow truncated cones of stone-ware to be made, which were sunk under ground at the station-points, deep enough to be sheltered from any plough or light accidental digging; they are well centered to the stations, so that on their discovery a signal-pole can be placed in them, to serve at any time equally as at first, as, by their nature, they will remain undecayed for centuries. Where the station-point fell upon a solid rock, I caused a hole, of about two inches in diameter, and seven or eight inches deep, to be drilled at the station-point, and filled with melted brimstone, which will equally serve to indicate the exact point of the station. An exact description of the locality of the station must, of course, form a part of the journal of each station, to guide in the discovery of the point at any future time.

15. It does not belong here to speak of the chasm that is found from that time until the renewal of the law of 1807 by that of 1832, which confirmed the former in all its parts, though with the condition that it shall not be considered as authorizing the establishment of a permanent astronomical observatory, which the most enlightened members of the Government had in 1807 and 1816 considered as a natural consequence of the law, because it should in fact form the fixed point in the hemisphere of America to which the work of the Coast Survey should be attached; wherefore also I had been directed to procure, and actually had procured, suitable instruments for such establishments at the same time with those for the Survey.

16. This peculiarity of the law of 1832 I have always considered, as stated already in one of my letters to the Treasury Department, as intended to provoke a more direct and separate proposition for the establishment of a proper national observatory, upon a greater scale than a mere accessory to the Coast Survey, and properly adapted to the standing of our country among the civilized nations that have a navy, for which such an establishment is an absolute requisite.

17. In taking up the work again in 1832, it was of course proper to take advantage of what had been done in 1817, as base of the operations to be made under the new law, its foundation being good, and all its principal points ascertainable, by the precaution taken, as stated above; the proper acceleration and economy of the work, and good principles, equally indicated that course, in preference to any other.

18. The first operation was therefore, to uncover again the station-points of the work of 1817, and to replace signals upon all the essential points; these were easily discovered, and signals placed upon them of the same kind as formerly used, namely, truncated cones of sheet-tin, elevated upon poles; only two of them, needed only at some future period for the southern extension of the Survey, were not yet found by the assistants who visited the places, but will certainly be found when more especially needed.

19. The direction in which the first extension of the work was by preference to be made, was to be determined by the consideration of where the most advantageous progress could be expected, in order that I might be enabled to present, at as early a period as possible, an

actually executed full scheme and example of the work. For these views the continuation of the work eastwardly over Connecticut and Long Island, presented evidently advantages over that southerly, through Jersey, &c.

20. The line between Wesel Mountain, near Patterson, New Jersey, and Harrowhill, near Hempstead Harbor, upon Long Island, had been determined in 1817 to serve for this direction; therefore I reconnoitred in the fall of 1832, and even in the winter, through a part of the Long Island hills, and over the elevations of Connecticut, that have those of Long Island constantly in view; and though in the various intermixtures which they present, all the information that I received from the inhabitants appeared contrary to success, I was so fortunate as to find a series of five to seven hills connecting very properly and to good advantage for a favorable chain of triangles; and even the corresponding points of Long Island proved more visible from one another than their position, almost in a straight line, had allowed me at first to expect, by the generally wooded state of the interior of the country. Signals were of course placed upon all these points, of the same truncated cones as were always used.

21. All the points thus reconnoitred were placed upon a map of Long Island, according to approximate observations made at them, constructed according to the problem of three points, dependent upon the light-houses of both shores of Long Island Sound. But besides that the intransparency of the atmosphere near the sea-shore in winter always renders distant vision indistinct, the actual inclemency of the month of January prevented the full decision upon the visibility of Wesel Mountain from Buttermilk Hill, in West Chester county, behind Tarrytown, which its locality promised to bring in the line from Wesel through the interruption of the hills of the Palisadoes and the northern hills of New York, commonly called the Notch, which was however of the greatest importance.

22. Circumstances out of my control delayed my stay in Washington above my expectation during the whole winter 1832 to 1833.

As soon as I had again arrived in New York, I placed upon the stations of Wesel Mountain and Harrowhill signals of larger dimensions, though of the same form as I always used. Then I began the summer campaign with the station of Buttermilk Hill, where it was necessary to ascertain whether that point would actually answer in full the condition of joining the triangulation of 1817 with the continuation of it that I had projected; this was actually verified, so that the whole of my projected triangulation promised to be proper and available.

23. Upon this first station I had of course also to put the instruments in proper adjustment, and to introduce my assistants into the peculiarities of the work and the observations, all which protracted so much more the stay upon this first station, in addition to the often unfavorable weather; the extremely unfavorable weather of the most part of the last season, in general, protracted our stay upon all the stations much beyond expectation, and what is hoped will be the case in future, particularly when the arrival of the new instrument

expected from London next summer, will dispense, in some measure, with the numerous and anxious repetitions and cares which the present state of the two-foot theodolite, that had to be used for the great triangulation, obliged me to go through; for this campaign has particularly proved that the accuracy and good state of the instruments is one of the greatest means of economy, by the greater celerity with which results can be obtained by them.

24. It would have been desirable after the success of that station of Buttermilk, to go upon Wesel Mountain and Harrowhill, to observe the angles of this main junction triangle, but it was also desirable to ascertain the whole series of triangles projected, and I hoped to make these stations at the close of the campaign in the fall, with more economy in the moving of the whole establishment. To get however the preliminary determination of the distances required for the calculations which it is necessary to make in the field to guide in the progress of the work, I determined this triangle by the given distance between Wesel and Harrowhill, of which the angle subtended at Buttermilk was carefully measured by the azimuth carefully observed there, and compared with one that I had observed in 1817 upon Wesel, though I had far less reason to rely upon its accuracy.

25. I prosecuted, therefore, my northern triangle-stations easterly, until past New Haven; and by return, the southern stations upon Long Island; and laid some triangle-points upon the southern sea-shore of the island. From these main stations I measured as many angles upon secondary triangle-points as the localities, time, and circumstances allowed, in the same manner as I had done in 1817. In the course of the work also another station-point was found, the substitution of which for that of Buttermilk will furnish a very desirable and very favorable verification of the large distances, by doubling the series of the largest triangles. I made, therefore, the proper observations for that, from the stations by which it will join the other triangles, the distribution of which is on another side, best adapted for the survey of the details in their neighborhood.

26. Upon one of the southern beaches of Long Island, appears to present itself a locality for measuring a base-line of more extent, and probably under more favorable circumstances, than that of English Neighborhood. This is now under nearer investigation by Captain Swift; and the necessary preparations for this operation, as important as laborious, tedious, and expensive, are in proper progress, as it must necessarily be the first work of this summer's campaign.

27. The operations before described having lasted until December, at which time we were upon the West Hills station, and the winter setting fully in, with the consequent intransparency of the atmosphere of the sea-shore, I was forced to abandon my plan, to visit the stations of Wesel and Harrow myself. To obtain, however, a better determination or verification, I directed these two stations to be occupied preliminarily by some of my assistants, though with inferior instruments: that will, therefore, not dispense my observing there in proper time myself. So, Mr. Blunt observed the angles upon Harrow, and Mr. Ferguson those upon Wesel; and upon their results, joined with

those of Buttermilk Hill, the present preliminary determinations are grounded, as far as they are dependent on this part.

28. When I had executed the station of Mount Carmel, the extreme eastern one to which I had intended to extend my observations that year, I considered myself authorized to form two parties, to carry on secondary triangulations within the limits of country that my main triangulation embraced, as the triangles could all be sufficiently determined to allow the verifications required in future: keeping, therefore, only two of my assistants, Captain Swift and Lieutenant Bell, with me, Mr. Ferguson was directed, with the assistance of a secundant, to fill up with secondary triangles all the parts included between the main northern triangle-points and Long Island Sound; and Mr. Blunt, with another secundant, was directed in a similar manner for all that related to both shores of Long Island; both equally proceeding from the eastern extremity of our work towards New York.

29. The secondary points thus determined must be sufficiently numerous, and placed in such a manner, as to enable from them to fill up all the details by plane-table operations on land, and by observations for the soundings upon the water. Considerable advance was made in these secondary parts already in the latter part of last fall; and the works have been taken up again this spring early, though the weather of that neighborhood has again proved very unfavorable.

30. Upon Buttermilk and Toshua regular series of azimuth observations with the sun were made, with the two-foot theodolite, by myself; and the latitudes of the most essential stations were observed by my assistants, partly with the eighteen-inch repeating-circle, partly with the ten-inch repeating reflecting-circles; by the calculations of this winter these latitudes were all reduced to one collective result by means of the azimuths, and their coincidence has been more satisfactory even than I expected.

31. These reductions, carried through the works of 1817 to the City Hall of NewYork, the latitude and longitude of which had been determined by entirely different means, gave the point from which the longitudes have been counted, as reduced to Greenwich, there being no other point within the limits of the Survey astronomically determined, nor any fixed point in the United States from which the longitude could be counted.

32. As well in my operations of 1817 as in those of last year, the angles of elevation or depression of the main station-points from one another, have always been observed, except at my two stations upon Long Island, because these will be revisited at a future time. These observations will furnish in time an interesting collection of data upon the elevation of all these points over the level of the sea; but, neither the winter of 1817 to 1818 nor this last, has it been possible, for want of time, to calculate any results; in fact, it is rather more proper to postpone these calculations, until the exact distances are fully determined upon which these results depend; they will, therefore, with more propriety form a part of the calculations of next winter.

33. Since I made, in 1818, my calculations of the elements of the projection that will be the most advantageous for the construction of

the maps, as most concordant with the results of both the triangulations and the detail surveys, the knowledge of the dimensions and figure of the earth has much improved, and been much more accurately defined. I had therefore to make anew all the theoretical calculations thereto referring, upon the most approved elements, of which the leading data are the ellipticity of the earth, and the mean degree of the whole meridian, that is, its three hundred and sixtieth part. It would, however, be out of place, in the present state of the work, to enter into these nearer details of theory, which will become of great interest hereafter, as the ultimate results of the Coast Survey must furnish one or more of the data for the perfectioning of these results themselves; if it shall take its appropriate standing among the works of this nature, it is to be hoped that it will be properly discussed at the end of the work of the main triangulation.

34. It may be here the place to state my reasons for adopting the metre for the unit measure of the whole Survey. 1st. I had a fully authentic metre, made by the Committee of Weights and Measures in Paris; while of any other measure whatsoever, I could only have a copy, more or less accurate. 2d. Notwithstanding older ideas to the contrary, I found positively, in my comparisons made for the weights and measures, that, in a general way, the metres are obtained of greater accuracy and coincidence than the English scales. (See my Report upon Weight and Measure Comparisons.) 3d. By my repeated comparisons of this identical and authentic metre with the scale of Troughton of 82 inches, adopted as English standard in this country, together with a number of other measures, its ratio to either one of them is sufficiently determined, to enable at any time to present any distance in either one of the measures thus compared: as for instance, to obtain the value in English inches, will need only the addition of the constant logarithm = 1,5952859 to the logarithm of the distance recorded in metres. 4th. In the ultimate general account, it will be proper to give the distances both in metres and in yards, or feet, to ease the utility for the various future detail applications of the work.

35. The connection of the station-points of the triangulation by their differences of latitude and longitude, was calculated upon the same theoretical principles stated above; they have coincided with the results of the latitude observations, that are by their nature entirely ndependent of the geodetical operations, to such a degree as, notwithstanding all my cares, I did not consider myself authorized to expect; and the reduction to the City Hall of New York showed an equal coincidence with observations made some years ago by Captain Sabine, on the occasion of his pendulum observations.

36. This afforded also an additional proof that the result of the measurement of the base in English Neighborhood, measured in 1817, would be sufficiently relied upon, for the preliminary calculations, as it stood the test of being extended to distances about 160 miles from the same. It confirmed equally the near approximation of the azimuths observed last year.

37. It is, however, evident that my dependence for the ultimate azimuths and latitudes of deciding accuracy, must as yet be referred

to future observations, with the superior means, of instruments, &c. that I have in part ordered, and have in part still to contrive; in respect to the longitude, it is too evident how desirable an observatory will be, as no doubt will be provided in proper time, by special means, independent of the Coast Survey.

38. My attention at the present stage of the work must be directed principally to the measurement of a base-line, with all the means of accuracy that I may be able to dispose of, by means of the apparatus of which I have given the description in my printed papers upon the Coast Survey; the brass parts of the apparatus were put in full good order already during last summer, the wood work is in construction in New York, under the direction of Captain Swift, and I have just now put the double metre bars, which shall determine the absolute length, to their proper standard, by means of the apparatus provided for it, and with the help of my assistant in the weight and measure business.

39. In the actual measurement of the base-line, I shall unite all my present assistants, principally because they will all take a great interest in the operation, which is in its kind of a peculiar nature, and not often occurring, wherein every operator will always follow his peculiar ways, according to his situation, and the means at his disposal.

40. As soon as the result of the base-line is ascertained, which will require some time and considerable calculation, the result will be applied to the calculation of all the triangles, and the reductions to the geographical positions will be repeated with this new element. Then a projection of the points, upon the scale of the fifty thousandth part, will be made upon papers, distributed over the extent of the work, in such parts as will be best appropriated to the filling up of the detail surveys, by the plane-table, and the insertion of the soundings, in which works the most of my assistants will then be distributed, while I shall proceed again in the main triangulation.

41. During the execution of these works I hope that the instruments, ordered of Mr. Troughton, in London, will arrive in this country, at least if he can execute the promises given to that effect; I hope, therefore, to be able to avail myself of the new large instruments for the continuation of my work in the main triangles, the determination of azimuths and latitudes, and all the more delicate observations, upon properly selected, favorable stations. The two-foot theodolite, that I have used last summer, I shall then propose to send to Mr. Troughton, to have it again put in a proper serviceable state, for that accuracy of which it is susceptible, when in good order.

42. At the same time with the distribution of the detail surveys upon hand, I should like to put in activity two parties of naval gentlemen, for ascertaining the soundings in the neighborhood of the same parts that the detail surveys would embrace, as they would probably sometimes work in conjunction with one another; they would embrace a great part of Long Island Sound, and part of the south shore of Long Island. This, however, will require to take some arrangements previously, in relation to the vessels, which it will be

necessary to employ in it. Lieutenant Bell of the Navy, who has been one of my assistants last summer, will take the direction of at least one of these expeditions, as his acquaintance with the locality will of course assist him much in the proper execution of this task.

43. I join to this report skeleton-maps of the triangulations that have been executed hitherto, containing all the main triangles that I executed, and so much of the secondary triangles, of the two separate parties, as have been communicated to me until now. The distances in numbers would be of no interest in this report, and belong only to a final report upon the scientific part of the work; it is at no rate proper to mention any, before the calculations have been grounded upon a final base, measured as above stated. These maps present four sheets upon the scale of the one hundred thousandth part, ($\frac{1}{100000}$) which is that upon which it will about be proper to execute the detail maps, for publication; the whole system of the operations, as far as hitherto executed, will become evident by them. It appeared to me to ease the general insight into the bearing of the work, to add a fifth sheet, upon the half scale of the others, that will present the general view of the whole work; the easier reference to the locality of the triangulation will be assisted by the tracing, only in pencil, of the approximate outlines of the coast, for the survey of which the triangles contain the elements. The projections are made upon the principles above stated, and will present no deviation for the filling up to the minutest details, when executed upon the scale of $\frac{1}{50000}$, in which it is proper to execute the main original copy of the Government.

44. It is proper that all the maps should be drawn upon a proportional decimal fraction of the real dimensions; there is a great advantage in being able to ascertain by the single measurement, in any length measure whatsoever, the real distances desired; this can only be obtained by such a system of scales, which therefore also is the only one adopted in the present time. The scales of so much in inches, or any other small measure, per mile, giving altogether an irregular proportion, are very bad, and therefore have been entirely abandoned in the new maps.

45. It is proper to add here some general remarks, upon the character which it is necessary to give to the work of the Coast Survey; its general bearing for the benefit of the country at large; and the influence which its proper execution shall have upon the improvement of the practical mathematical sciences, that are so necessary in our country; and the standing of the Officers of the Army and Navy, to whose departments works of this nature, or requiring similar knowledge, are so often referred; though I have already touched this subject upon other occasions.

46. The Survey of the Coast must evidently, merely as such already, extend land inwards, at any place, until to the ridges of hills or mountains that border the valleys emptying their waters into the sea, or the large bays and rivers; it must present the localities of all the passages and gorges that lead to these valleys, &c. &c., because it must contain all that is needed for the proper defence of the coast in case of any attack whatsoever, just as much as the outlines of the

coast and the soundings; because, as these furnish the guide to the navigation, so the others are the elements upon which the directions for a proper defence of the country, in case of need, must be grounded; and all these elements must be so detailed, and present such a full and self-explaining picture of the country, that, with the map before the eye, the military operations may be properly judged and guided in the Cabinet. It is therefore also habitual to join for each district a statistical statement of its natural means and resources; it is as desirable to have these accounts of the land part as those upon the currents in the naval part of the work.

47. This work must besides furnish the elements of any other survey that may be desired for any public aim whatsoever, either within or in the neighborhood of its extent; its accuracy, if properly executed, and its wide range, render it peculiarly fit to become a standard to which all other surveys may and even shall be attached. Thereby will be gradually obtained the necessary accurate data for any public undertaking of general utility to the country. This feature of the work was felt already in 1817, when the Governor of New Jersey proposed to unite with it the survey of a map of that state; but which was lost by the delay of the decision of the Treasury Department, where I had proposed to accede to the request. It appears equally felt now, by the proposition of the State of Maryland, for a similar junction of the map of that state, which has been very properly acceded to; and no doubt similar occasions will increase in the same proportion as the general improvement of the country advances, and the proper character of the work of the Survey of the Coast becomes established; this is another proof of the propriety of the measure that I took at all times properly to secure the station-points for future use.

48. The character of a work of the nature of the Coast Survey is essentially scientific; unless this character be impressed upon it to the evidence of the public capable to judge of it, neither credit nor confidence will be given to it; it is in fact worse than useless, because it increases the doubts of the cautious and intelligent seaman, and its defects mislead the ignorant who trusts to it:—plans going merely upon what is so wrongfully called sufficient accuracy are inadmissible, and would prove highly expensive. The economy in the work consists in the certainty of producing the most accurate results.

49. In the execution of the laws in any country, and in a new country in particular, it appears to me to be a duty to take all possible advantage of it to promote as much as possible the general benefit of the nation, and especially its scientific improvement, wherever there may be an occasion presented for it, and that upon a liberal scale; because its benefits are always far more extensive than what shows itself at the first outset. I am authorized to this assertion, in the present case, by the approbation which my mode of treating the Coast Survey with these views has caused me to find in the most enlightened men of the country, and even abroad, as testified among others by late President Jefferson himself, who was the author of the original law, and by

many other distinguished citizens. We have besides before us the well known examples of almost all European countries, who have derived valuable benefits of various kinds from the proper execution of similar works in a scientific form.

50. With these views also I found it proper to collect a valuable library of the best works in those parts of mathematics and natural philosophy that are either directly bearing upon the work itself, or more or less connected with its accessory or influencing branches; by which my assistants may properly improve their scientific standing, and become the more useful to the country in future. It will also be proper to add to the work, as soon as it is in a proper train, such scientific experiments or observations as relate to the pendulum, the magnetic attraction, the tides, refraction, and other similar subjects, which are always connected with such works, when properly scientifically treated. I could as yet not do more in this than to cause the magnetic bearing to be observed upon the main stations, merely to determine the declination of the needle at the places and time; but for any other observations nothing is as yet properly provided, nor in fact was there time at disposition for it.

51. By the nature of the services that the navy and the army are engaged to render to the country—these two classes of citizens, that are always of considerable influence in any country, deserve peculiarly, though not to the exclusion of other citizens, to be quoted here in connection with this work. Such officers in either of these services as have applied to the study of the higher branches of their profession, of which mathematics form the foundation, will find in the work of the Coast Survey an occasion of improvement, as well as of gratification for their good dispositions; therefore preference is naturally to be given to those who, with a good foundation in theory, have been successful in the career of practical applications of mathematics, in topographical surveying, drawing, and particularly observing and generally in making geodetical and astronomical observations for actual use. Only such officers can reap some benefit for their individual improvement, or be of any service in the work, because this utility must be reciprocal if success shall attend on either side; the officers or individuals whosoever, joining the work without sufficient knowledge, and even practical ability, cannot reap any benefit from following it, and of course they are also entirely useless for the work, and the Coast Survey would be improperly laden with them.

52. The success of those officers, that have in the work both given and received satisfaction, will invite others to acquire the qualifications indispensably required to become serviceable, and thereby to enter the work; but the work itself cannot be the school for him who is too far behind to be of some actual service in it; the distance to be gone through is too great for him, and the functions of all those actually engaged in some part of the work are too constant, and too fully occupying them, that he might be taught, and schooled, separately who brings not knowledge enough to the work to see himself what he can do, as well in application of his actual acquirements, as

in advance of them. All this applies, of course, equally to the assistants from any rank whatever.

53. To all this it is still necessary to add, that habits of assiduity, and devotion to a scientific object, with friendly and open dispositions, without any pretension, are equally indispensable moral qualifications, to which it is necessary to attend, in the selection of the assistants in this work, as much as to their intellectual qualifications and acquirements. For there can, by nature, not be any control upon any observation entrusted to an assistant, or over the assistance rendered in an observation, except the moral strength of confidence; orders from superiors, fear of consequences, and all considerations of that kind, cannot have the slightest power; the morality and ability of the observer at the very moment decides, what no power whatever can decide. And this is equally applicable to any chief, or any assistant whosoever, and of whatever grade he may be in the work.

54. In thus exposing the principles that must guide in the selection of the assistants for this work, and which shall, therefore, ever guide me in the proposition of any assistant, of any rank or class whatever, I give the pledge, that I shall always be guided by perfect impartiality as to the personal, though I may propose persons of different qualifications, with the view of their different employments; the moral principle which must guide in all such cases, is simply, that every one must see before him an aim for his inclination or ambition, to which he will apply his exertions honestly, the result of which will be useful to the work. With these principles, I hope to be as successful in my choice as the general chances of human affairs will admit, and to be approved in my selections; therefore to obtain from the civil, naval, or military rank, always such assistants as will act with pleasure and satisfaction, and therefore do honor to the work and to themselves, thence reflect credit upon our country and nation; convinced, as they must be, that they act before the whole of the civilized world—because the history of such works is always minutely known to every well-informed man.

55. I can, therefore, also fully rely upon the concurrence of the Department, under which the work is placed, as well in the aim as in the means to reach it successfully. This success must be one of its greatest aims, upon the consideration of usefulness as well as upon that of its high credit.

F. R. HASSLER.

Washington City, May 17th, 1834.

Notices upon the Maps of the Triangles herewith joined.

Four sheets upon the scale of $\frac{1}{100000}$ present, as well the main triangles as the secondary ones, in such sheets as will be proper to allow the necessary room upon the sea-side for the insertion of the soundings, and the insertion of the details of the land near the coast, thence adapted to the actual execution of the charts and maps for publication upon a large scale; they are, of course, properly oriented perpendicular to the meridians and parallels.

No. 1. Contains the neighborhood of New York.

No. 2. Exhibits the continuation of the country, in the same latitude as the former, over Long Island eastwardly.

No. 3. Has that part of the triangulation that falls north of the first sheet, therefore principally the triangle points land inwards, connecting with those of the shore.

No. 4. Contains the triangle points north of sheet No. 2, thereby presenting the part of Connecticut east of No. 3, and the north part of Long Island Sound, in the neighborhood of New Haven, &c.

A fifth sheet is added, presenting the union of the whole work, equally oriented, but only upon the half scale of the preceding ones, that is $\frac{1}{200000}$ part, to show the full connection of the works; to assist in the reference to the localities of the country, the rough outlines of the coast are traced upon this sheet, by which it becomes evident how the triangulation will apply to the detail survey of the minuter configuration of the country, shores, bays, &c.

F. R. H.

NAVY DEPARTMENT,
May 21*st*, 1834.

SIR:—Your letter of this date, with your report upon the works made for the Survey of the Coast of the United States, during the time of your agency in it, "together with the maps of the triangulation," have been received.

The report and documents accompanying it have this day been transmitted to the President.

It is desirable that the copies of all papers relating to the Survey, lost in the late fire at the Treasury Department, shall be placed on file in this office as soon as they can be completed.

As the appropriation for the continuance of the Survey has already passed the House of Representatives, most of the remarks deemed proper to be submitted by this Department to Congress will be incorporated into the annual report of November next.

I request that you will, before that period, furnish the Department with estimates of the expenditures proper for the ensuing year, a general view of the progress made between this spring and November, and such other observations as may be considered conducive to the most successful prosecution of the Survey.

I am, very respectfully, &c.

LEVI WOODBURY.

F. R. HASSLER, Esq., Washington.

Washington City, May 22d, 1834.

MOST HONORED SIR:—When in 1832 the Survey of the Coast was again given into my charge, I proposed the contract made in 1816 as a form, as relates to my compensation and allowance for expenditures, with such modifications in various respects as, according to the circumstances, appeared likely to lead to more precision: but the Secretary of the Treasury substituted for it the letter of the 9th August, 1832, and reduced the allowance for my personal expenses from $2,000, as it had been rated before, to $1500.

I considered it first of all important to show that the work, as I proposed it, would be satisfactory, which I thought would certainly produce liberal dispositions in relation to it therefore: though I knew the reduced allowance could not possibly suffice, I accepted, with the condition and reserve which you will find underlined in the copy of my letters joined to the present; to which the Secretary of the Treasury never made any objections; wherefore I always considered it fully understood, and accepted tacitly. I grounded, therefore, upon this my request to the Treasury Department, which you will find in the file of letters under 12th January last, requesting an additional allowance under the denomination for the weight and measure works, which it appeared to me could most easily bear it, not weighing in the account of a separate appropriation, as you have seen by the letter communicated to you in conversation.

This was only acted upon the day before yesterday, and negatived from the side of its applicability to the weight and measure works; I must therefore take the liberty, by the present, to request that you will give it further consideration, upon the ground of the Coast Survey itself, and the assurance that I can give to you, that far from the unavoidable expenses to which I am subject in this work being less than in 1817, when I formerly worked in it, they are considerably greater, from the increased price of all those objects that come under my private expenditure, the influence of my more advanced age upon them, and from other circumstances out of my control. My actual pecuniary losses last year were great, and have placed me in a very painful economical situation: it is to be hoped that they will not always be so; but they will certainly always amount to from $500 to $1000 over the stipulated allowance. I take therefore the liberty to request that you would please to augment my annual allowance for expenditures in the Coast Survey to about that amount.

But it is not my wish to cause any interruption in the work, particularly at this moment, when I am just preparing to go off to the most important field-work, and the press of business of the Government may not allow time for a full consideration of the case. I wish that the decision may be taken only after having properly inquired into the subject, by information from persons acquainted with the facts relating to it; as, for instance, Colonel Abert, who, having been my assistant in 1817, can give positive information—all or any one of my present

assistants—and a number of other persons acquainted with the consequences of works of this nature, &c.

Therefore, I have this day procured a loan of money sufficient to bring me again to the locality of my field-work, and I continue my preparations so as to leave here about the middle of next week, and only request you will please to communicate to me, as soon as possible after, to New York, the ultimate, as I have every reason to hope, favorable decision.

I have the honor, &c. &c.

F. R. HASSLER.

Hon. LEVI WOODBURY, Secretary of the Navy,
Washington City.

NAVY DEPARTMENT,
May 23d, 1834.

SIR:—Your letter of the 22d instant, with inclosures, has been received.

I will be happy to confer with the President and others on your application for increased compensation. The result will be communicated to you hereafter, as requested.

I am, very respectfully, &c.

LEVI WOODBURY.

F. R. HASSLER, Esq., Washington.

St. Petersburg, June 3d, 1834.

MY DEAR SIR:—I wrote to you about twelve months ago, and requested you to send me 500 copies of your logarithms. I sent the letters by Mr. Buchanan, the late American envoy at our court. Most likely my letter has not reached you; for I have waited in vain for the logarithms, which I expected to a certainty to arrive with the first ship coming this season from America. I now repeat my request, with this difference—to send me, in lieu of 500 copies, 1000 copies, provided they may be had at the price I offered—a dollar a copy, free of all expenses, to be delivered here: the money will be paid immediately on delivery.

If my offer is not accepted, I beg you to inform me as soon as possible, in which case I shall print myself such tables as will suit us.

I am very anxious to be informed whether you have already commenced your Survey. Pray let me know what progress you have already made. I have a double interest in it: firstly, as an under-

taking of the kind must necessarily interest every professional man; and, secondly, you are at the head of it—a task you are superiorily fit for.

The Emperor has ordered to be built, near St. Petersburg, an observatory, which will, most likely, be the richest in instruments of all those now existing. The director of it is to be Mr. Struve, who will have four first-rate astronomers with him, each of whom is to have a department to himself.

Requesting you once more to let me have an answer as soon as possible,

I am, my dear Sir,
Yours respectfully,
KRUSENSTERN.

F. R. Hassler, Esq., New York.

New York, July, 1834.

Most honored Sir:—It appears to me proper to keep you informed of the gradual progress that I am able to make in the work of the Coast Survey, under circumstances so much less favorable than would be desirable, by the historical account of the proceedings since I left Washington.

In Baltimore I made a short stay in order to be informed of the progress made by Professor Ducatel and Mr. Alexander for the preparations of the survey of Maryland. Mr. Alexander was absent; Mr. Ducatel, just coming to Baltimore, told me that the Legislature of Maryland having decreed him surveyor of rail-road routes, they had found proper to satisfy this minor call first, and therefore nothing yet had been done relating to the survey for the map. The more than sufficient mass of work that lies before me for this year makes this delay from that side rather favorable for my present plans.

At Philadelphia I found occasionally that the beam compass and proportional compass belonging to the Government, that had been stolen with my trunk on my passage last winter, had been bought by the mathematical instrument maker Young; I found most economical to buy them from him at $4 50, as legal suit for their delivery, as stolen goods, though I could prove the identity to the greatest accuracy, would have delayed me long, and would have led to much greater expenses.

Immediately after my arrival here I went to West Point, where I received the astronomical part of my former library, as agreed for with the War Department, and which can be of no use to the academy; all those books that could be of some use there I had omitted in the catalogue made up for that purpose. I made also the exchange of the clock, as had been agreed upon by the same letter; besides that I borrowed a transportable transit of Troughton which was

there, being more convenient for laying the direction of the base-line than the two feet theodolite, and also with the view to save this valuable instrument. This latter I intend to return after the ending of the base-line measurement, though it is originally the property of the Land Office, as well as the transportable clock. I found here the preparations for the base measuring apparatus in considerable forwardness, as for the necessary carpenter work and such like. I put therefore the work of adjustment of the parts in immediate activity, which occupied me and all the assistants and men present for a considerable time all the day in the loft of the Custom-house, which has served as a place of deposit for all our instruments and effects since the beginning of my operations in this neighborhood.

Last fall the base apparatus had been left with Mr. Patten for cleaning and proper packing, (while I was in Washington;) as he failed early last spring, the objects were removed to the Custom-house by Capt. Swift. On examination, the telescope for directing the bars was missing, and had to be replaced; three eye-pieces of the microscopes are also missing, therefore we must do without, as they cannot well be replaced now.

While thus engaged, arrived here a theodolite of one foot diameter, that I had ordered of Schenk, in Bern, (Switzerland.) The instrument proves to be a very fine one. It was at first thought that, as it came under my directions, it would be subject to pay duty, and I wrote to the Comptroller upon the case, who, mistaking the case, also considered it so, but upon the reception of it and showing the case, many of my assistants being present, it was delivered to me free of duty, as it would have been useless to charge the Coast Survey with it.

Some parts of it had been injured; I had them therefore immediately mended by a young German artist acquainted with this kind of instrument, and whom I have engaged among the manual assistants of the Coast Survey, where he will render valuable services.

The bill of lading of the various objects delivered by Mr. Troughton to Bookseller Miller in London, for the Coast Survey, has also arrived under the directions of the Collector of this port; his absence obliges me to treat with the clerks here for the liberty of opening the package, to prevent their useless forwarding to Washington, while several of the objects are of immediate use for my present work. The package has not yet been delivered from the ship Sovereign; it was at Pine-street wharf since fully a week. During these operations we formed gradually a company of manual assistants of the different classes which we are in need of, and, according to present appearances, we have been pretty successful in our selection. Two days ago the assistants present and the most of the laborers have left here with the instruments and apparatus for the station to be formed upon Fire Island beach, partly by water and partly by land. By the time that they will have made the necessary preliminary arrangements I hope also to have received the objects arrived from London, made my field provisions, and replaced as far as I am able my field equipment, which was stolen from me last winter, occasioning to me a loss of about

$300, for all which I had not yet a moment before, and then I shall leave for the same place, where letters directed to the Post-office of Babylon, Long Island, will meet me. Mr. Ferguson has brought his secondary triangulation towards New York till to Valentine's hill, which was the limit set for his work for this spring. Mr. Dahlgreen is now engaged in placing the earthenware cones in all the secondary stations that have been made on the north side of the sound. Mr. Blunt will have finished in two days his task upon Long Island for this spring.

We shall therefore all unite in a few days upon the intended station. The next of Messrs. Ferguson's and Blunt's works will then be to unite in connected operations for the determination of those points upon both shores of the sound which, being separated from the triangle-points behind them by woods, are only ascertainable by triangles from the opposite shores, and which are necessary to bring the distance between the secondary triangle-points within the short distance required for tertiary or the detail operations of the plane-table. The operations of the secondary triangulation have been greatly impeded by the constantly unfavorable weather, either rain or fog, and indeed since I am here there has been no more than two or three days in which the base measurement could have been carried on successfully. All those necessary works and the uncontrollable delays that occurred having still added to those encountered last winter, is known to you. I cannot expect to reach in this campaign the full aim that I had proposed to myself. I hope however to reach the main part of it, and to begin to put the tertiary or full detail operations and some sounding in a train of beginning; these will therefore likely be the main results, besides the base-line on Fire Island beach, that I may be able to present next November, in addition to my report handed in before I left Washington.

It will depend on the time of the reception of the great instrument from Mr. Troughton what part of the main triangulations I shall be able to add by my personal work with it; the promises are for next month, but I shall consider myself highly favored if I receive it in September. To work further with the two foot theodolite which I used last year, in the state in which it is, involves such a great loss of time, that it is proper to refer the important work until the arrival of the new instrument, though I shall also partly supply it by the theodolite of *Schenk*, just arrived.

I have the honor to be, &c. &c.

F. R. HASSLER.

Hon. LEVI WOODBURY, Secretary of the Navy,
Washington City.

Fire Island Beach, opposite Babylon, L. I.,
August 9th, 1834.

MOST HONORED SIR:—The Auditor of the Navy Department being, as it appears, unacquainted with the details of the economical arrangements of the Coast Survey, has made objections to several items of the accounts of Captain William H. Swift, of the engineers, who is the accounting officer for the work; I must, therefore, take the liberty to communicate to you, for his direction, the following statements of the facts and of the principles of the organization of the accounting part of the work, such as they actually are.

1. The Coast Survey Law commits the work especially to the President, without reference to any Department. Mr. Gallatin was first charged with the correspondence by President Jefferson, under his own direction. This principle has always been preserved since; so that it has always remained a special trust of the President, disconnected with either army or navy, and purposely kept in another Department, for the obvious reasons which I have detailed in my letter to the Treasury Department of the 14th March, 1834.

2. All the principles of the organization of the work have been settled, in 1816 and 1832, with me by the Treasury Department, and the accounts have passed there always without either objections or alterations, because the whole was understood. These passages of the accounts ought, therefore, to be the guide of the Auditor, who may now, or in future, have to pass these accounts. It must, in general, be understood in any Department which they may have to pass, that the regulation which may be in that Department for its other business transactions, have no bearing whatsoever upon the arrangements of the Coast Survey, because it is a separate organization of itself, and can never be otherwise if it shall be executed honorably and in a permanently useful manner.

3. Already in 1816, I was authorized to take any measures in relation to transportation that I should find best appropriated, and peculiarly in relation to purchase, and of course maintenance of carriage horses and drivers, which are absolutely requisite to move the instruments, the other objects relating to the work and the whole company engaged in it. To hire horses and conveyances would be quadruple the expense, as some of the accounts prove, which were incurred on such occasions as were not sufficiently provided for; and to have the instruments, &c. carried by men, would require a cartage of forty men, in addition to the six or ten that we now usually have, for the manual labor required in the work. Already this liberty given to me, implied my hiring men whenever the work required it.

4. In 1816 and '17, soldiers were used for the manual assistance as laborers; in 1832, the statements given in relation to the army, and the simplification of the arrangements as well as economy, decided the Treasury Department to commit to me the direction of the hire of the laboring men as I should find most adequate, and at the best terms I could for the benefit of the work. Thus have been engaged more

or less as the circumstances required it, and such as were not needed dismissed, during the winter, &c.; always by consultation and decision between the accounting officer and myself. The same was the case with the field equipment.

5. For the assistants the documents prove, that I have to make the proposition for their appointment and their rank, which decides of course their compensation, (upon which besides I shall have the honor to address you shortly,) and the Treasury Department has approved every one specifically. The proper organization of the work dictates this course, which was always, from the first origin of the work, agreed with me, and has proved good in practice—no one can be appointed without my proposition.

6. The main original collection of the instruments and books has, as you know, been made upon my proposition, approved by the President (Jefferson.) In 1832, I showed the necessity of procuring some large new instruments, besides a number of others, and to continue the library that had been begun, as it is proper to keep pace in it with the modern progress of science in this branch, for those of my assistants who would show an inclination to apply properly to the study required; for it is well understood: that this improvement of my assistants is one of the most desirable accessary benefits of the work. I was then authorized, as I had been in 1816, and even in 1811, to make the necessary purchases of instruments and books; of the latter, a number have been received already by the medium of our legation in London, (like in 1817 by that of Naples,) and more are ordered and expected, both from England and France. For the instruments of a large size a draft of £600 was purchased and remitted to Messrs. Troughton & Simms in London, while the others of a less amount have always been purchased as occasion presented, and appear thus in the current accounts. In a similar way I have lately transferred that part of my former library which I had always as yet reserved for myself, and is so well adapted to the library of the Coast Survey—(the assistants were allowed to use of it before like now.) The catalogue has passed the review of a competent bookseller, as to the fixation of the prices. That part of my library that I had sold to West Point, having special reference in a scientific view to our works, has upon the same ground been transferred to the library of the Coast Survey by special agreement. Such measures are proper, and even necessary, for the work, and its proper character; I have, therefore, at all times during my former and my present engagement in the Coast Survey, purchased or transferred from my own possession such books, and even smaller accessory instruments as were proper—generally after having allowed the use for the public work long before hand—and at prices that gave me no benefit, but generally a loss.

7. Also, the Navy Department has, by the letter of the 10th April last, given to me the authorization to supply such instruments as I should find proper by such others as I should find better adapted. For this there is almost daily need as the work increases in extent, as much as for hiring more manual laborers. Without full liberty, as I had it always hitherto, in respect to the procuring of instruments

and books, the hire of men or conveyance, either by land or by water, the work becomes impossible. Two cases occur now that we are entirely deficient in, because an instrument that has been ordered could not yet be received, and by the necessity of supplying a temporary increase of men. In no such case it would be possible to get in due time special instruction or authorization from Washington, or enter into discussion with any person whatsoever not present at the work, who would be absolutely precluded from forming a proper judgment upon the case. This has hitherto always been included in the trust put in me, by giving me the superintendence of the work; as well as it is allowed to any sea-captain to set the sails of his vessel according to the wind at sea.

8. Some trifling travelling expenses for the horses and drivers, both at the expense of the Government by full authority, have been objected to, while others exactly of the same nature have been admitted. The authorization to provide for conveyances, which was explicitly given in 1817, covers certainly one as well as the other; and as far as such accounts occasionally come from me, when I move alone with the instruments or otherwise for the work, taking only a driver with me to lessen the expenses, I can only remark that if I had not done so in 1816, 1832, and even last spring, the whole work would never have been begun; as in all these cases I always first defrayed the public expenses out of my private money, as the documents prove most fully and authentically.

9. My signing the schedule of the accounts by the statement that, "these expenses were incurred in consequence of my directions for the Survey of the Coast," has been objected to as insufficient; however, this is also fully in order and according to my agreement, and has always been considered as a proof of the legality of the expenditures; as I positively and constantly refused any nearer mixing in the accounting concerns, and this was always highly approved. This statement was all that was desired of me, and every account has hitherto passed fully free with it, (even in the works that I did for the Weights and Measures, where my simple "approved" upon the schedule was considered sufficient.) Also this part must therefore remain, to accomplish the contract under which I work, if inconveniences shall be avoided much graver than may be thought.

10. My two first letters to the Navy Department, in March last, gave ample information upon the organization of the work. No alteration whatever was contemplated in it by the transfer of the trust of the President, from the Secretary of the Treasury to the Secretary of the Navy; all that I stated there has always been fully approved, and as stated above, cannot be changed without destroying the work and its character.

11. Upon these considerations, I take the liberty to request that you would please to give to the Auditor or Comptroller, through whose hands the accounts may have to pass, the information that all the subjects relating to the accounts have been settled long ago, and at proper times, and are therefore to continue to be considered as such in future, upon the same principles as the accounts have at all times

passed in the Treasury Department, where it will be easy to find parallels to every item that has fallen into the accounts since the work is in the Navy Department, or will occur in future.

I have still to acknowledge the receipt of two letters from your Department, relative to the arrangements for the contemplated soundings, with one for Lieutenant Bell, which he will answer about with the mail of this.

I shall shortly have to address you in relation to the compensation of my assistants, when being at the head of a secondary triangulation. Already last winter I intended to have this subject settled, but many intervening circumstances have postponed it.

I understand that also some stage-fares of assistants have been objected to. I must remark upon it, that the transportation of the whole company, effects, instruments, baggage, &c. being at public expense, such accidental expenditures, occurring when our regular conveyances cannot serve, are upon this principle to be paid like any other incidental expense; they appear always only when the travelling is to or from the work, in the course of and for the work, never for any incidental travelling of their own, which however occurs very seldom, as they are all very steadily at their business. Such items are therefore to be admitted, and the accounting officer and myself be considered as having full acquaintance with the case and its full admissibility.

I hope all the above information will be satisfactory, and that the accounts will in consequence be passed in full, &c. as soon as possible. Two quarters being now hanging, it is very desirable for the easy progress of the work, that this part should not remain behind, in order that we may know upon what means we may calculate.

I have the honor to be, with perfect respect and esteem,

Most honored Sir,

Your obedient servant,

F. R. HASSLER.

Hon. MAHLON DICKERSON, Secretary of the Navy,
Washington City.

Station Head and Horns, Fire Island Beach, opposite Patchogue (Post Office), September 16th, 1834.

MOST HONORED SIR:—The favor from your Department of the 10th instant reached me properly.

Upon the information that Lieutenant Gedney will soon be ready for taking up functions in the Coast Survey, and be provided with a vessel of his choice, I take the liberty to request that he be ordered to meet me, about the first or second week of next month, at the station, at which I may be then, which he can easily be informed

of at the Post Office above quoted, upon the southern road of Long Island.

Lieutenant Bell having signified to me that he would leave the Coast Survey, and that had reported himself for other service, I intend to give to Lieutenant Gedney the task which I had intended for Lieutenant Bell, as it will be the most conducive to show the principles of the work in its details at an early period. By the time above stated, the works previously required, to ground his upon, will be in sufficient readiness, and he will receive here the necessary communications to guide him.

On this occasion I must take the liberty to observe, that the third article of my agreement for the Coast Survey, in 1816, stipulates on the part of the Government, "The party of officers, men, and assistants accompanying you, (me) will be ordered to conform to your (my) instructions."

The agreement of the 9th August 1832, confirms, in relation to the organization of the work, all the dispositions of the above first agreement.

In order, therefore, that proper regularity may be observed in the work, I must take the liberty to request, That every officer, directed to report to me, be furnished with an order conformable to the above article, of which he be directed to hand over to me a copy, signed by him, to have our mutual relations documented in my hands.

I have the honor to be, with perfect respect and esteem,

Most honored Sir,
Your obedient servant,
F. R. HASSLER.

Hon. MAHLON DICKERSON, Secretary of the Navy,
Washington City.

NAVY DEPARTMENT,
25th September, 1834.

SIR:—I request that you will transmit to the Department, an inventory of all public property that has come into your possession as Surveyor of the United States Coast, including all that you have purchased for the service, except provisions.

I am, very respectfully, &c.
MAHLON DICKERSON.

FERDINAND R. HASSLER, Esq., Surveyor of the U. S. Coast,
Patchogue Post Office, New York.

Station Head and Horns, Fire Island Beach, opposite Patchogue, Long Island, September 27th, 1834.

MOST HONORED SIR:—Your favor of the 24th instant, was handed to me this evening, I shall of course attend properly to furnish Lieutenant Gedney with the necessary directions upon his work when he comes here.

I must take the liberty to request a speedy decision upon the different questions involved in my letter of the 9th of August, relating to the accounting concerns, because their importance is vital, and the delay proves a detention to the progress of the Coast Survey. I have tried in that letter to show why and wherefore the authorizations that the accounting officers of the Navy Department appear to doubt of, were granted to me from the very beginning in 1816, and confirmed by the agreement of 1832. I can, therefore, not have the least doubt upon the decision falling out, as I stated it necessary.

But after having lost in the attempt to give to the country of my adoption, a work, as honorable as useful, besides the exertions of the best years of my life, $15,000 in money, or its equivalent objects, and being in trust upon my authorization, already personally engaged for necessary objects for the work, ordered abroad, I could not with propriety give the orders, which I was just going to give, for the objects needed to present in the course of next winter, a sample of the manner in which the maps shall be ultimately executed, the delay has therefore postponed this satisfaction for the Government, and myself, *for one whole year;* because of the necessary distribution of the work, according to the seasons, which commands to use all the seasons, that admit of field-work, to that part, and only the winter for drawing; besides that the meeting of Congress during winter, indicates this season as the proper one for the aim.

As far as these objections of the accounting officers refer to my transfer of books, which is on my part a sacrifice, and on the side of the work an advantage, it has produced; that being here insulated, away from all friends, menaced to be laden with an unexpected debt, I was forced to such an economy in my living, as, in conjunction with the laborious task in which I am just now engaged, has ultimately produced the loss of my health, for I rise out of the sick-bed to write this letter; this, though no advantage for me, is certainly neither favoring the Coast Survey, nor benefiting the Nation or the Government.

Another instance in the case occurred since my letter, Dr. Wm. Howard of Baltimore, of the corps of Civil Engineers, died. He had always desired to join the Coast Survey, and I wished it, because he would have been the best assistant I could have got for his branch, but he was always refused. With predilection for this branch of science, and the means he was possessed of, he had procured a valuable collection of books referring to it, which are not as yet in the collection that I made for the Coast Survey; he had also some instr-

ments that would be useful. The general habit of this country, in case of death, being rapidly to sell all at auction, my intention was to acquire all that I should find appropriated for the public benefit, as far as committed to my charge, at the same time preventing its being squandered and lost, among people not knowing the value of the objects, like instruments, actually belonging to the Coast Survey have been.

Upon this I had of course also to stop taking my measures under the existing circumstances. Your decision will allow me to act immediately, (if it is not perhaps too late already,) if it gives me that authorization, which was always implied in my agreement for the Coast Survey, and complied with by the passing of every item of the kind in the accounts to the Treasury Department, namely: perfect freedom in the procuring and using of the means needed to execute the trust in my hands. In fact, if the direction of the work is entrusted to me, the means to do it are implied, and have always been considered so. Most likely the arrival of Lieutenant Gedney will occasion a question upon the same point, which if I dare not decide it, will also delay him.

The accounts sent in long ago by Capt. Swift, the accounting officer, have not yet been returned passed. Regularity in this service would, however, have been very advantageous in this case.

I have the honor to be, with perfect esteem,

Most honored Sir,

Your obedient servant,

F. R. HASSLER.

Hon. MAHLON DICKERSON, Secretary of the Navy,
Washington City.

Station Head and Horns, Fire Island Beach, opposite Patchogue (Post Office), October 1st, 1834.

MOST HONORED SIR:—I rise again from the sick-bed, to answer, in moments of relaxation of my fever and my weakness, your letter of the 25th ultimo, which I received in bed yesterday, requesting an inventory of all the public property in my hands for the use of the Coast Survey, except provisions.

1. The general list of instruments and books, as I brought them from London, shall be among the documents upon the Coast Survey in your office.

2. There shall likewise be among those documents the receipt of my delivery in 1818, and those of what I received again from the Topographical Bureau in 1832, this last making the inventory of what I received.

Another catalogue is appended to the Report of the Navy Commis-

sioners of (I believe) 1830, to a letter of Commodore Rodgers, printed among the Documents of Congress, when the law for the Coast Survey was again proposed.

4. One instrument was allowed to Massachusetts, which is yet in their possession; for details, I must refer to your documents again.

5. Instruments were ceded to Captain Talcot, and account was settled upon them with the Navy Department, the details of which are unknown to me. Some of the instruments intended for him were taken away, and some remain yet deposited in the Custom House of New York, where also some of those of the Coast Survey are; so that I am uncertain what is yet belonging to the Coast Survey, or not.

6. There are not instruments enough of the Government on hand now for the works; therefore, one of the assistants works with his own instrument: for another, I have caused to be transformed into a theodolite the lower circle of the repeating-circle broken by the hail-storm in St. Regis, which, though not fully what would be desirable, still answers much better than would have been expected, and gives the practical proof of the value of my new method of observing: for more assistants, in the line of triangulations, or the like, I have no instruments.

7. The two-foot theodolite is, as stated in my report, in such a state as not to be useful with proper advantage, and must pass the hands of the artist who made it.

8. Two plane-tables and alidades only are on hand, and more must be procured: I had already ordered one at Standiffe's, in Philadelphia, who died before doing any thing to it. It is my intention to have some constructed next winter under my own inspection.

9. To supply me temporarily with an instrument, I have here with me the theodolite of one foot, of Schenk, received last spring; instead of which I mean to employ the large instrument ordered at Troughton's, when I get it: it was promised for last spring; and if I get it next spring, I shall have to be highly satisfied.

10. Another (eighteen-inch) theodolite, for secondary triangulation, is also ordered at Troughton's, as by Art. 6. you see is necessary, besides other instruments, and accessories of all kinds, which, during the time from 1818 to 1832, had found other applications, and were not more on hand in 1832. Two heliotropes are constructing in Göttingen, under the direction of the inventor, the celebrated Professor Gauss, he volunteering kindly his assistance, from mere scientific interest in my work.

11. A full inventory of the instruments it will be more proper to make when those ordered will have been received; as in the present state, and as I have received the instruments, and not yet been able to supply deficiencies, &c., it would not make a good appearance: it is only by dint of exertions and combinations, that it was possible to work with them hitherto.

12. I have here with me the theodolite of Schenk, the base-apparatus, the repeating-circle of eighteen inches, 2 reflecting-circles with artificial horizons, 1 barometer (in bad order), 1 iron chain, 1 plane-

table and alidade, 1 four-foot eight-inch telescope of Tully, 1 small telescope, several beam-compasses, and rules, and 2 chronometers.

Two assistants in secondary triangulation have the theodolite made of the broken repeating-circle, one $3\frac{1}{2}$ foot telescope of Dolland, and 1 ditto of Troughton.

In the Custom House of New York are, the two-foot theodolite (out of order), the standard scale of eighty-two inches, 1 six-foot telescope of Dolland, 1 thirty-inch dividing plate, 1 nine-inch theodolite (intended and authorized to be disposed of), 1 reflecting circle, 1 plane-table and alidade, and the books from West Point.

In Washington are, 1 five-foot transit, 1 clock (out of order), 1 six-foot telescope, 1 iron toise, and 1 iron metre.

Three chronometers were sent to London to be repaired.

13. A more detailed account, including all the accessories of this kind, would require my going to these different places to make the inventory, which would be the greatest abuse that could be made of my time at present, when I am fighting with difficulties and sickness, and must watch a favorable day to close the work of measuring the base-line, which you know is the most laborious task, and, as it will be $8\frac{3}{4}$ miles long, not a small one. My report of next month will inform you nearer upon it.

14. A catalogue of the books was made in Washington last winter; but it contains, of course, not yet the books received at West Point last June, of which you shall have the list among your documents; and, as the opposition made to the transfer of mine would of course alter it, I must reserve to myself not to deliver it under existing circumstances. Upon the arrangement in relation to the exchange with West Point, the documents lie in your office.

15. For all the articles of equipment, means of conveyance, tents, kitchen utensils, and the like, I shall communicate your letter to the accounting officer, whose special business it is to attend to these things; and I take the liberty to refer to the original agreement that this is not under my personal care or responsibility: my only duty in it is, to direct the accounting officer to procure such things as will be needed, and, in so far as they relate to the work, of proper quality. It is self-evident that the man, charged with the scientific part of a work so arduous as the Coast Survey, cannot be laden with these details without the greatest detriment to the work; therefore, this was positively understood in both agreements with me; and had I been obliged to attend to such things last year, the report of an actually, in extent, unparalleled work—(the Topographical Bureau, having experience in such things, can be consulted)—that I have presented, would have been impossible, and would have turned into an account similar to that of a steward.

16. I must only remark upon this latter item, that a great deal of it is of a transitory nature, as much so as the provisions, and therefore the inventory also daily changing. So, for instance, a great many of the absolutely necessary tools, the signals, and earthen cones for station marks, &c. are as much mere provisions as bread and cheese can be; and as for the unavoidably necessary kitchen tools, every house-

keeper knows their fate. In fact, however, every item of that kind is contained in the accounts that have been rendered; and if a comparative account of the standing of this part, after the unavoidable wear and tear of a season, is required, this will be best referred to the close of a campaign, like last year: on leaving the field, a proper inventory was made.

I have the honor, &c.
F. R. HASSLER.

Hon. MAHLON DICKERSON, Secretary of the Navy,
Washington City.

Inventory of Articles purchased by Captain W. H. Swift for the use of the Party engaged in the Survey of the Coast of the United States, under the direction of F. R. Hassler, Esq., from the 4th of April, 1833, to the 30th of September, 1834.

One twelve-inch repeating theodolite (Schenk); 3 beam compasses with magnifiers; 1 2½-inch sextant; 1 twenty-two-inch telescope; 1 dividing engine (old); 4 pendulum knives; 6 amethysts for pendulum; 16 tripods for base apparatus; 1 box and appendages for ditto; 1 fly for ditto: 1 large umbrella for ditto; 30 microscopes legs for ditto; 2 instrument stands; 1 stand for telescope; 1 cover for ditto; 1 leather barometer case; maps of New Jersey, Connecticut, and New England; 1 chart of Long-Island Sound; 2 almanacks; 1 small atlas (U. S.); 2 pamphlets (longitude of the Capitol); 1 Herschell's Astronomy; 1 leather case; 1 manifold writer; blank books of various kinds for journals, &c.; drawing-paper and stationery generally; 2 packing trunks for books and stationery; 12 wall tents, with their tarpaulins, poles, and pins, complete; 4 common or soldier's tents for the base apparatus; 18 pair of blankets for the hands; cooking utensils for ditto; 3 willow hampers for packing the same; 1 medicine chest; 1 box instrument and machine tools of various kinds, for repairing instruments; 1 box containing carpenter's tools of various kinds; 6 shovels, 1 spade, 1 hoe, 2 axes, 1 iron crowbar, 1 grindstone; 4 horses; 4 sets of harness complete for the same; 2 wagons; 1 saddle, 2 bridles; 1 wrench hammer; 1 boat with anchor, sail, &c.; 2 stone pillars for the base.

Tin signals and earthen cones have been purchased as they have been wanted, and used accordingly. The same to be said of lumber.

The articles purchased by the former accounting officer, prior to the 4th of April, 1833, (and now in possession of the party,) were 4 horses with harness complete, 1 carriage for the instruments, 1 wagon for reconnoitering and placing signals, 1 wall tent and 2 instrument tents, and 1 saddle.

The carriages, with the horses belonging to them, remain in the main party. The two other wagons, with their horses, are with the parties engaged in the secondary triangulations—one in Connecticut, and the other on Long Island, Fire-Island Beach.

October 3d, 1834.

West Hills, November 11th, 1834.

MOST HONORED SIR:—With the present I have the honor to forward to you my additional report, agreed upon, and desired, by the President, at the time when my report of last May was handed in. The causes of its delay are known to you; however, it was ready some days since, only waiting for the sketch of the detail triangles of Mr. Ferguson, which is just this day finished.

I received just now also your favor of the 7th instant, requesting this same report, which however I had announced to you in some of my last letters, as in hand.

As the report will speak for itself upon the subjects thereto relating, I will not here detain you with any remarks, but answer the other part of your letter, requesting me to state the amount of appropriation that it would be proper to request of Congress for the next year's work.

The appropriation of the current year has been $30,000. I do not know how much of it is remaining; Captain Swift will be able to inform you. I can only say, that I tried to save all expenses that it was possible to save, not only in general principle, as I always do, but also with a view to retain, at all events, means in advance in hand for next year; because, next Congress sitting being a long sitting, and the appropriations being generally made at the end, it is proper that funds should be disposable to progress with the work under such circumstances; and against such a case it is necessary to provide by the appropriation now to be asked for. Thus I had done the first year, and it was the only means that enabled me last year not to let the work be interrupted for want of funds during 1833. This precaution is absolutely necessary; for, if ever any such interruption should occur, the whole summer's campaign would be so crippled as to postpone all results for a whole year.

Next year I should like to extend the detail topographical operations, so as to be able to present a final result of maps, to be executed during the following winter. This extension, which is so desirable, can however not be done without an extension of the expenditure, the other parts remaining as they have been hitherto.

It would therefore be desirable that an appropriation of $40,000 should be obtained. I may add yet the observation, that my intention has hitherto been to provide this winter for the construction of the instruments necessary for this extension of the detail topographical surveys

under my own inspection—as you know well that the necessary instruments are not on hand, neither in the Coast Survey collection nor otherwise, not even in sufficiency for the present establishment—that therefore some funds more than otherwise habitual during winter would be consumed from the present appropriation. How I am in a state of suspense in this, like in fact upon the whole organization of the work for its proper progress and effect, is known to you, and will excuse me for not stating details any nearer.

In general, no detailed estimates have ever been asked of me, nor are they in fact possible, until some years experience will have given means to make the average calculation, as well upon my part of the work, when in regular train of triangulation, as how much each party in the secondary triangulation, and in the detail topographical surveys, will amount to during one year.

In absence of the possibility of giving a proper estimate upon these principles, and because mere random estimates are, in my opinion, highly improper, I have hitherto always calculated the extension given to the work by the means that I had at my disposition; and so I succeeded in never leaving a gap of means by out-reaching the disposable funds, which would be a very great detriment to the work, and highly uneconomical. I shall therefore continue to act upon the same principles, and the extent that I shall give to the work will be decided entirely by the appropriation.

Instruments, and even books, maps, and various other things, will be required; many have been ordered that will become payable the coming spring or summer, which will also diminish the advance in hand from the present appropriation.

I have the honor to be, with perfect respect and esteem,

Most honored Sir,

Your obedient servant,

F. R. HASSLER.

Hon. MAHLON DICKERSON, Secretary of the U. States Navy,
Washington City.

P. S. I am sorry your other letter has been miscarried to Patchogue, where I must send a man on horseback to fetch it, about thirty miles from here, if I will prevent its being sent back, there being no direct regular communication between there and here.

Report of F. R. Hassler, as Superintendent of the Survey of the Coast, additional to that dated May 17th, 1834, containing an Account of the Progress of that Work during the Summer and until November of 1834.

1. I stated in my report, of which this is to be a continuation, as well as in many previous communications, that the accurate measurement

of a base-line, by the means especially provided for that purpose, the description of which is published long ago, was, after the measurement of the angles of the main part of the triangulation, presented in that report, the first and, as well known, most important part of the work; to that I had therefore principally to devote my attention and personal exertions this summer.

2. I also stated in that report, that from the observations upon the stations of Rulands and Westhills, upon Long Island, there appeared to present itself the prospect of a base-line far more advantageous, in every point of view, than that measured preliminary in English Neighborhood, New Jersey—namely, upon the beach called Fire-Island Beach, upon the south shore of Long Island, which separates what is called the great South Bay from the ocean.

3. Viewed from the two named stations, this beach presented a narrow strip of land, that appeared straight between the lighthouse, at the inlet of the bay, and the station-point called Head and Horns, and perhaps even farther. Its position lies eminently favorable for the determination of the distance from Westhills to Rulands, which presents itself extremely favorable as a base for the large triangles, crossing Long-Island Sound over to Connecticut, &c., as evident by the maps of the triangulation joined to my report of last May.

4. These advantages were too great not to decide in favor of this location of the base-line, for the execution of which Captain Swift was preparing all the mechanical means in New York, during the time that I wrote my last report, and before. But it would have been very desirable that the actual work could have been begun with the earlier part of the season; this, however, was impossible, on account of a considerable part of my time being taken up in Washington, in the latter part of the winter, to give to the Navy Department all the information, that was requested, on account of the correspondence upon the Coast Survey being transferred to that Department from the Treasury Department, where all the detail arrangements of the work and the tenor of the agreements made with me were known from their very beginning.

5. When I could join my assistants in New York, in the earlier part of June, the means being all on hand, I directed the final adjustment of the whole base-measuring apparatus and what is connected with it; there were also engaged an adequate number of men for the manual assistance required, in the selection of whom we were really fortunate to obtain all efficient regular men, of such different qualifications as are absolutely required for the very varied exigencies of an accurate measurement of a base-line, and the extra works that it requires, in a place entirely isolated, and thence distant from all other means to provide for them.

6. I directed then all the assistants, not otherwise especially engaged, the men, and the apparatus, and equipment, to Fire Island Light-house, in the neighbored of which the west end of the base-line was to fall; and directed the assistants, joining there, to make a detail survey of the beach, from its western end, till to Head and Horns, or even Watchhill; such a previous survey being always necessary, to enable to select the most favorable ground for the actual measure-

ment. The map of this locality hereto joined proves this evidently. Two lines between Head and Horns, and some points near the Light-house, proposed, and scrutinized first by my assistants, presented such difficulties, by intervening sand-hills and bushes, as not only would have required a great length of time in overcoming, but also would have occasioned chances of inaccuracy, besides a great deal of calculations for the consequent and necessary reductions to the too much interrupted horizontal line.

7. When I could join my assistants upon the beach, in the beginning of July, though by no means in a good state of health, and after having visited the projected lines, the difficulties they presented decided me to try to lay off a straight line upon the outward sandy shore of the ocean, between the sea and the sand-hills, which appeared to present a nearly straight line, little different from parallel to the shore. This succeeded so well, that a line was laid out, starting from a sand-hill of moderate elevation, somewhat south-east of the Light-house, and extending over eight miles upon the sandy beach, only in a few instances edging the sand-knolls, and in some others going between the high and low water mark on the sea-side; the lowering of the first, as much as needed, it was easy to accomplish, and the second apparent difficulty, was equally easily overcome, by so regulating the work, as to meet these places during low tide.

8. This line was then laid out accurately straight, by means of a transit instrument; and measured preliminary by the same chain of twenty metres, which had been used in 1817, for the preliminary measurement of the base-line in English Neighborhood, and which serves now for the detail plane-table survey of the south side of Long Island. At every four hundred metres, a peg was driven into the ground, bearing the mark of the distance; these precautions are always required, as a great means of security against mistakes, by the omission that might happen of inscribing a measuring bar box in the registers, as thereby constant verifications are presented.

9. During the months of August, September, and October, this line was then measured in forty-five days, of which twenty-seven in August, fifteen in September, and three in October, the other part of that time being taken up either by interruption from unfavorable weather, or such days as were necessarily employed for the moving of our encampment along the line, for which it was always necessary to employ all the helps otherwise engaged at the manual part of the base measurement; there being never any doublets of men engaged in our work, and I must add, near the end of it also, by my own increased state of sickness.

10. At every four hundred metres, as determined by the accurate measurement, and at every one thousand metres, strong pegs were driven in the ground, marked by their distance from the west end, and every two thousand metres was besides furnished with one of the stone ware cones, that are always used at the station points; these are intended as fixed points, from which the detail points, of the soundings in the sea, that they border, are to be determined.

11. Both ends of the base-line, thus resting upon two sand knolls,

that will by their position, in all appearance, always be secure from the sea, have been marked by two monuments, each consisting of a Newark red sand stone, of about four feet high, hewn square for about eighteen inches from the top, with an even top of one foot square, and a round hole in the centre; under the square cut part, a frame was fixed in, consisting of four pieces of hard wood scantling, embracing it closely by grooves, made expressly in the stone; the lower part being left rough. These stones were sunk entirely even with the sand, together with their frames, which by their extending about twenty inches on each side farther in the ground, will make them stand more solid, and maintain their perpendicular position.

12. The distance between the monuments will exceed fourteen thousand and fifty metres, or eight $\frac{1}{100}$ miles; the accurate number will result from the calculations that I shall make next winter, upon the reductions needed for:

1. The varied state of the temperature.

2. The elevations and depressions, that the localities of the ground obliged to make in many places.

3. The reduction of the line actually measured upon the shore sand, to that between the monuments; for which all the data have been determined upon the place.

13. The apparatus used for this measurement, is that which I have described in my printed papers upon the Coast Survey, which, though grounded upon entirely new ideas of my own, has obtained the approbation of all the men of science acquainted with such kind of works. It has also proved a very expeditious, therefore even an economical arrangement, as the line was measured in the same time, (forty-five days) as the base-line of Mr. De Lambre of eleven thousand eight hundred and forty metres, which mine evidently exceeds considerably. In fact, this base is one of the longest lines ever measured with an accuracy in any way comparable.

14. The details of the operations in principle, and even the manipulations, are already described, in my "papers upon the Coast Survey," and as the statement of the final numerical results, must naturally be postponed until after the adequate calculations will have been made. I have here only yet to state the great satisfaction which it gave me, that my assistants, engaged with me in this arduous task, naturally entirely new to them, acquired the manipulations of the apparatus so well, that when otherwise favored by the weather, and the locality, we proceeded with a rapidity far above all expectations; and their cheerful exertions during the whole time, and even that of the laboring men, deserve due praise, and were a great support to my personal exertions, particularly towards the end, when my ill health had rendered my personal exertions very difficult and fatiguing.

15. The detailed account of this operation, which is of rather a scientific nature, I flatter myself, will be of interest, and therefore enhance the value of the methods that I have devised for the works of the Coast Survey, as well as increase the interest for the work, with the Government, and the well informed public in general; in fact, this

account of the work belongs rather to the ultimate scientific account of the main triangulation for the whole work.

16. I had expected at the close of last campaign, that after the measurement of the base-line, I should be able yet during this campaign, to measure the angles of the triangles, that will determine directly from it the distance from Westhills to Rulands, and also those angles on Harrowhill and Wesel, which connect my work of 1817 to the present; this I intended to do with the large instrument ordered of Troughton, and promised in due time for that purpose. But unfortunately, not only this instrument has not yet arrived, but even many unexpected impediments have arisen, that have made the execution of my projects impossible, and deprive me even now of the use of the means, by which I had intended to supply this deficiency. Besides that the lateness of the season, at which the campaign could be opened, postponed naturally every thing for equally as much as my stay in Washington had been protracted, as above stated; an accessory result of which was, that the season for living and working at the sea-shore, falling partly in the equinoxial storms, not only our progress was impeded, but it reduced me ultimately to the sick bed, and the lingering state consequent to it, which last even now, increased and maintained by the difficulties laid in the way of my progress. I had therefore also to avail myself of the assistance of Mr. Blunt, whose operations were near the base-line, for the measurement of the accessory and preliminary angles, that had to be measured at different places of the base-line, for which besides neither I, nor any of the other assistants engaged at the actual measurement, could leave our functions.

17. Though the two assistants engaged in the secondary triangulations, Messrs. Ferguson and Blunt, were some part of the time with me at the base-line, particularly Mr. Blunt, they have continued equally their tasks, as I stated in my last report that they were engaged in, namely, Mr. Ferguson in Connecticut, Mr. Blunt upon Long Island, continuing the secondary triangulations, of which a part is already included in my report of last May; the comparison of the sketch of Mr. Ferguson's triangles here joined with the map of my last report, will show his part of progress; the necessity of calling off Mr. Blunt for the triangulation around South Bay, and to the base, has made it impossible to present with this report a corresponding sketch of his work, besides that herewith from the said South Bay.

18. It is my intention to have the topography of the south part of Long Island near the base-line fully executed this fall, as well upon land as for the soundings of the great South Bay, that lies between Fire Island beach and the main shore of the island. With that view I marked off a part, from the west end of the base easterly, of such length as would serve as base for the triangles, adapted in size to the dimensions of that bay. Such a triangulation was then grounded upon it, by Mr. Blunt, as envelopes the whole bay from its entrance to its eastern extremity, as shown by the sketch here joined.

19. The results so obtained were projected upon the scale of $\frac{1}{10000}$,

to serve for the filling up of the topography with the plane-table, at which Mr. Renard is just now engaged.

20. In the same manner Lieutenant Gedney of the Navy, who has been appointed, upon my proposition, for the first expedition of soundings, namely, that of the bay so enclosed in the triangles, and the sea-shore adjacent to the beach, has been furnished with a projection of these triangles upon a scale sufficiently large to make his preliminary constructions for placing the soundings, in which service he is now engaged upon the bay.

21. It was my intention to procure from Paris the material and implements, (which hitherto I have furnished out of my private stock,) necessary to have a fully finished map executed of the part of the coast in the vicinity of the base-line, where the topographical details are now executing and the soundings are now taking, by which I would have been able to present this winter yet, a real sample of the execution of the maps, early enough yet to lay it before Congress during the course of the coming session; also examples of drawings in all the different scales that it will become necessary to use were to be procured, as I have only (in my private possession,) a single example upon one scale, that was presented to me long ago by Mr. Beautemps Beaupré, of the Depot de Marine in Paris; for it must be here observed, that these objects are not obtainable from any other place than Paris, or where they were brought to from there, and that there has been established for all such works an universally understood conventional language of signs, and manner of distinguishing the objects, which appears not yet much known in this country, and which it is necessary to adopt, in order to be properly intelligible for every body, and to present the results also from that side, so as it is proper in the present state of science. But the impediments mentioned in my correspondence as laid in my way for the best forwarding of the work, by procuring the necessary means in due time, has frustrated me of the pleasure of giving that satisfaction this year; this can only be remedied the following winter, (if in the mean time the difficulties are levied.)

22. The secondary triangulation made by Mr. Ferguson is now brought till to the Pallisades on the west, from New Haven, where its eastern part begins, and that of Mr. Blunt upon Long Island parallel to it, both upon the plans as already stated, though I had to interrupt Mr. Blunt several times for works at the base-line, as above stated.

23. Thence also of all these parts of the country the work is brought to its ultimate application to the minute details of the topography, which I therefore intend to put in full activity as soon as the necessary arrangements can be made, which in the present state of things is impossible.

24. I am sorry to be obliged to state here yet, what is otherwise evident to every man, who occasionally is a witness to the work of the Coast Survey, that from the most important to the minutest part of the work every thing is arranged in the most strictly economical manner, and at the same time so as to produce the greatest possible effect, in perfectly accurate results in the shortest space of time; for in

this principle lies the true economy of the work; any arrangement whatsoever not fitting to this aim, is a direct loss, as well in work as actually also in money; my experience, by having made similar works formerly at my private expense, I find a sure guide in this respect, and I dare to assert with full confidence that never so much actually valuable work was obtained in the same space of time, and for the same proportional amount of money, in any survey whatsoever.

25. By the change of the Department to which this work is committed, it became necessary for me to spend much time in giving the informations necessary to introduce many gentlemen, completely new in the business, into the proper genius of the work, and its most advantageous organization, which lies in documents reaching from 1807 to the present date, during which time, on one hand the arrangements were constantly perfectioned, while on another even the older documents, in the hands of the Government, have been destroyed by the conflagration of the Treasury Office, so that now I am alone in the possession of them in their original. I had already some time ago begun the copies to restore these documents, and they needed principally only my revision and signature, but it has become necessary to make use of so many of them that the collection is now very incomplete, and actually my time is otherwise too much engaged to attend to this part at present.

26. As this report is rather to be made in haste, to reach in due time for the aim of the President, to present it with the Message to Congress, in addition to that of last May, minute details have been excluded. I expect however to have presented the principal features and the state of the work to sufficient satisfaction for the present purpose, and to have made evident that I have continued the work according to the principles laid out for me from its first beginning in 1816, that is, in a manner *honorable and permanently useful to the country*, which was already the judgment that late President Jefferson, with whom the first law of 1807 had originated, gave upon my work of 1817, and if nothing is altered in my plans and my organization of the whole arrangement, I can promise equally good success for the further continuance, and even assure that by no other means, or arrangements, it is possible to obtain such a result; for this the judgment of all the practical and experienced men of science in this line all over Europe is already recorded in the scientific prints.

F. R. HASSLER.

Westhills, Huntington township, Long Island,
11th November, 1834.

Addition.

The neighborhood of this base line is peculiarly remarkable for the Coast Survey, from the circumstance that it is just the place of the coast of Long Island, where the most vessels shipwreck, because the sea-charts generally represent this coast straight, while in reality it makes a considerable angle out in the sea, so that for vessels arriving from the east, the captains, thinking themselves safe in sailing straight

on, after seeing the shore in the evening, are stranded next night at this projecting point; this is proved by the number of wrecks, the remains of which are strewed all along the base-line, and in one of which actually one of our intermediate marks stands; notwithstanding that the habit of the inhabitants of the beach is, to buy the wrecks, and clear them away as soon, and as much, as possible, we found when we were there, the remains of about eight such vessels: one that had stranded while we were there, was cleared off entirely during the time, and we made use of pieces of it to shelter the base apparatus from the waves, when we were passing between high and low water mark; and one stranded there since.

F. R. HASSLER.

Maps joined to this Report.

I. Maps of the locality of the base line.
II. Sketch of the secondary triangulation around Great South Bay.
III. Sketch of the secondary triangles in part of Connecticut and New York states.

Westhills, November 23d, 1834.

MOST HONORED SIR:—My sickly state of health when I wrote my report, not leaving me time to think of every thing, I omitted in it a circumstance, that may serve to give a direct proof of the utility of the work of the Coast Survey, and thereby increase the interest for it. I take the liberty to communicate it to you herewith, praying you will be so good as to have it inserted after § 15, or as a note at the end.

I sent the long box, containing my report and three maps, to Babylon, to be mailed, in order to gain a day in its celerity; the postmaster, however, was uncertain whether he would mail such a large package, and gave it only to the care of the driver, for which he thought even first, he had a right to ask separate pay; however, no account has as yet been handed in to me. But having not received any notice of the reception, I am anxious about it, and therefore would be very much obliged to you for the notice of its reception, for my relief.

I have the honor to be, with perfect respect and esteem,

Most honored,

Your obedient servant,

F. R. HASSLER.

Hon. MAHLON DICKERSON, Secretary of the Navy,
Washington City.

Extract of the Report of the Secretary of the Navy, of 29th November, 1834. *Signed Mahlon Dickerson.*

The charge of the Coast Survey, now under the superintendence of Mr. Hassler, was on the 11th day of March last, transferred from the

Treasury to the Navy Department, to which it was thought more properly to belong. I have found this arrangement very onerous, as it imposes upon me new duties, which could not be performed without a careful examination of the accounts of what had heretofore been done on the Survey, contained in a voluminous correspondence, between the Treasury Department and the Superintendent. This arrangement also caused a short interruption in the progress of the work; but which has, nevertheless, been prosecuted with diligence and zeal by those employed in it.

The report of Mr. Hassler, of the 17th of May last, and his supplementary report of the 11th of last month, with the maps, drafts, and sketches accompanying the same, herewith transmitted, show the progress already made in this work under the law of 1832, and its connexion with the progress made in the same, in the year 1817.

The situation of the base-line on the south side of Long Island, has been most fortunately selected; as any error in this line would be attended with corresponding errors in the whole work depending upon the same, the utmost care has been taken to have it measured with the greatest possible accuracy.

From what has been done in this Survey, we may reasonably hope that this important work will advance with all the aid which science, skill, and industry can give it, and in a manner as honorable to the Government, under whose auspices it was begun, and has been continued, as it will be useful to the present and to future ages.

The information wanted for accurate and detailed estimates of the necessary appropriations for the continuance of the Coast Surveys, cannot easily be obtained, until further experience shall enable the officers engaged in it to introduce more system in the detail of duties and expenditure in their work, than they have hitherto been able to do.

The sum of thirty thousand dollars was appropriated for this purpose the past year, and it is believed that an equal sum will be wanted for the ensuing year, as stated in the estimates.

Extract of the Report of the Secretary of the Navy, of the 30th November, 1833. Signed Levi Woodbury.

The Survey of our Sea-coast having been placed in charge of the Treasury Department, it is not in my power officially to state its progress; but officers have been detailed, and all available facilities provided, whenever the wishes of those superintending the subject have been communicated.

Extract of the Secretary of the Treasury's Report of the 2d Dec. 1834. Signed Levi Woodbury.

In the preparation of new weights and measures, on the authority given in the act of 2d March, 1799, and on the principles set forth in

a report from this Department, of June 20th, 1832, coupled with the provision on this subject in the constitution, some progress has been made since the date of that report. But the difficulty in procuring the most suitable materials from abroad, has retarded the completion of the work, and the present engagement of the distinguished gentleman, specially employed to superintend this business, and which engross most of his time, in a survey of the coast, may with the circumstance before named, prevent the final accomplishment of this desirable object another year. But it is hoped that then, either at the arsenal in this city, or at the mint, the most natural and appropriate place, the new weights and measures will be satisfactorily finished, and greater uniformity and accuracy attained on a subject in which, both as to revenue and commerce, it is much needed, and will prove eminently useful to the public.

The Survey of the Coast before alluded to, has, since the last annual report, been transferred to the charge of the Navy Department, with which it seems to be more intimately and appropriately connected. With this survey the situation and utility of our present light-houses, already being 199 in number, besides 20 light-boats and the necessity for others from time to time, would seem to be in some degree fitly associated. As a measure likely to lead to economy, in not extending the establishment of light-houses beyond the real wants of the country, and in fixing their exact localities, so important to the safety of our navigation and navy, it is respectfully recommended that in the survey now in progress, Congress should require the latitude and longitude of every light-house to be carefully ascertained, and published, the importance of its position to be inquired into; and that no new one be hereafter erected till a report is made in respect to its public benefits, by the two collectors and the commander of the Navy Yard nearest to the proposed site.

Extract of the Memoirs of the Royal Astronomical Society of London, Vol. VI. Report of the Council of the Society of the 8th February, 1833. Page 232.

The Council regret that the Standard Scale, mentioned in their last report, has not been finished. It is a work that necessarily takes much time, due attention being requisite to the minutest points which are likely to affect its accuracy. Whilst on this subject the Council cannot omit noticing a public document, laid on the table of this Society at their last ordinary meeting, which contains several new and interesting comparisons of two of the principal European standards of length. This document is a comparison of Weights and Measures, made by our associate Mr. Hassler, to the Congress of the United States of America, and has arrived very opportunely, prior to the adjustment of the present standard.

☞ *Detail documents* may be produced when needed.

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ERRATA.

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3	13	activity	utility
4	17	apportioned	approportioned
5	4	of work	of a work
19	16	given	give
—	18	detail of surveys	detail surveys
21	16	actuating	activating
25	14	success proceeding	success, if proceeding
26	2	proposed the mission	*add*, to me
1	6	plates; I	plates; which I
28	29	sold him	sold to him
—	38	telescope	telescopes
30	35	T. T.	J. J.
32	28	reason given	reason for the preference given
—	49	produced	procured
33	4	made at	made and placed at
—	19	triangular	triangles
—	33	finding a	finding of a
35	10	Clov:	Cherry
—	27	to for	to me for
—	45	small	fall
57	13	given	quoted
66	last	microscope:	microscope stand;
67	49	Antoles	Antonief
68	25	Wringels	Wrangels
74	last	III.	II.
77	24	allow one to	allow to
79	14	these	three
—	35	as admitting	as are admitting
80	37	object	subject
82	42	more on	more means on
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97	first	1832	1833
102	12	from the	of the
—	26	any of	any Document of
105	6	present	pressing
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108	25	to theodolite	to the theodolite
—	26	we engaged	we were engaged
110	30	as they	as that
114	24	under weigh	underway
119	20	Dahlgreen	Dahlgren
129	12	1832	1818
130	31	Chairman	Chairmen
132	3	clossing	closing
134	5	Trüchsel	Trächsel
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138	13	April 3d	April 9th
143	23	coincidence of	coincidence of the
145	21	Island	Island Sound
146	18	measured by	measured, by
148	45	would	could
156	12	to it	to it;
157	25	him surveyors	some surveyors
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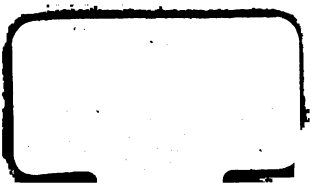
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